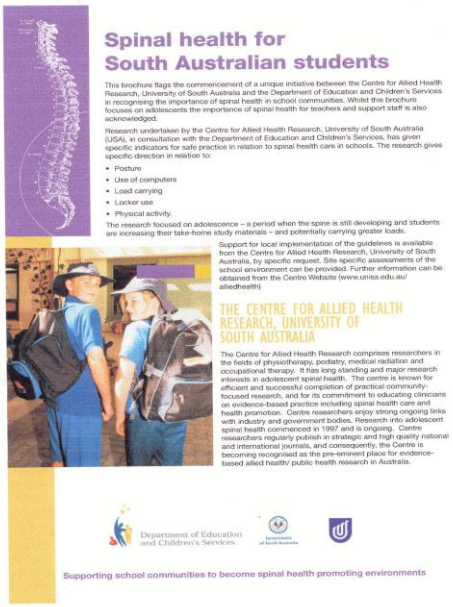

University of South Australia

PROTECTING THE SPINAL HEALTH OF YOUNG AUSTRALIANS

Resource Manual for Curriculum for English, Mathematics, Science, Health and Physical Education, Society and the Environment

Designed for First Year High School Students
Aged 12-14 years

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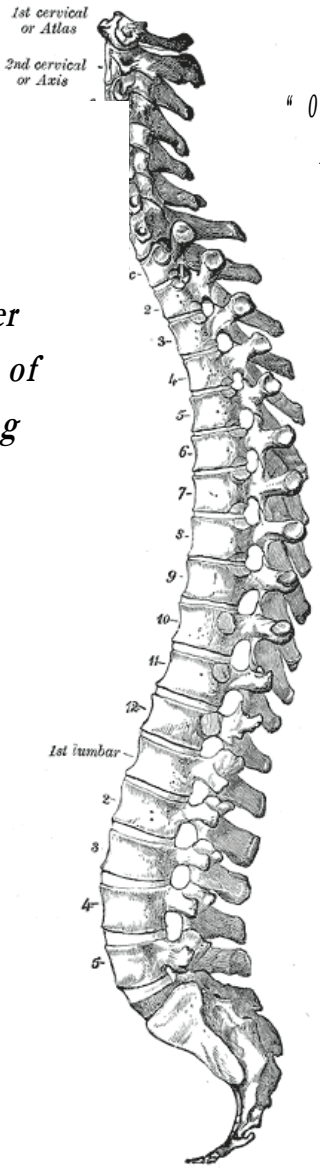
SOMETHING CAN AND MUST BE DONE BY SCHOOL COMMUNITIES TO PROMOTE GOOD ADOLESCENT SPINAL HEALTH FOR FUTURE GENERATIONS!!!!

"Up to 40% of adult Australians suffer repeated episodes of back pain, resulting in days off work"



"Over 80% of adult Australians will suffer disabling back pain at least once in their lifetime"

Experts believe that causes of adult back pain may be set up in the growing years

'Introducing good spinal health messages into core first year high school curriculum is an effective way of influencing whole of school thinking!!!' *Prof Esther May, Acting Pro-Vice Chancellor, Division of Health Sciences, University of South Australia, May 2004*

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Did you know?

Adolescents are most vulnerable to long-term spinal damage because their spines are growing at such a rapid rate. Carrying heavy backpacks regularly, sitting and standing poorly, and not getting enough physical exercise can all contribute to poor spinal health.

By managing these risks, and being aware of good posture, adolescents can avoid back pain now, and in the future.

Did you know?

Physical inactivity has been established as a major risk factor for the development of coronary artery disease. It also contributes to other risk factors including obesity, high blood pressure and a low level of HDL cholesterol. Even modest levels of physical activity are beneficial.

Why is exercise or physical activity important for children and adolescents?

Physical activity helps build and maintain healthy bones, muscles and joints. In addition, physically active children enjoy other health benefits, such as:

- weight control
- lower blood pressure
- improved psychosocial well-being
- a tendency to be more physically active as adults

PhysioPak front view

PhysioPak back view

www.physiopak.com

1. Introduction

Research undertaken over the past eight years by the International Centre for Allied Health Evidence (iCAHE), University of South Australia, in consultation with the Dept of Education and Children's Services (DECS), has identified the need to educate teachers and students about adolescent spinal health care with the aim of reducing the prevalence of current and future adolescent and adult spinal health problems. The research provides specific information and direction for appropriate school teaching and learning activities in core subjects in the middle years of schooling. The young people entering this year level (aged 12-14 years) are not only vulnerable to spinal damage because of their adolescent growth spurt, but also because many of them are confronted by the unique health and safety aspects of secondary school life. These health and safety aspects include the postures assumed whilst in the class room (use of furniture, computing facilities, classroom setup), load carriage (both to and from school, and in the school environment), the use of lockers, and young people's physical activity and exercise habits.

The research focuses on mid adolescence (adolescence has been defined by the World Health Organisation as between 10 and 19 years of age). Mid- adolescence is a period of time when the adolescent is undergoing significant development both physically and emotionally, whilst being exposed to the new health and safety issues associated with potentially different teaching approaches and learning environments in the high school environment. Potential changes include the need to carry greater loads more often, to sit in different sized furniture than that they were accustomed to, and the need to sit for longer periods of time than they were required to in primary schooling.

Schools have duty of care and occupational health safety and welfare responsibilities, to implement strategies to promote good spinal health practices, and to ensure that their students' spinal health is unchallenged during these significant developmental years. A policy document prepared by the iCAHE in 2001, and ratified by DECS in South Australia, provides guidelines for schools in recognizing health and safety issues for adolescents and suggesting strategies that protect their spinal health. This document is provided in the generic resources section.

This curriculum is a middle schooling inter-sectorial initiative of iCAHE and DECS. It sets out a framework of teaching/learning modules for first year high school students and their teachers, which incorporates the findings of extensive research undertaken by iCAHE. These modules are designed to complement the existing curriculum in five core teaching and learning areas, using the guidelines provided by the DECS and the South Australian Curriculum, Standards and Accountability (SACSA) Framework. The ideas outlined in this document provide ideas for teachers to develop and implement within their own class environment. The modules have been tested for validity of content, acceptability in the school environment, applicability in the classroom (for teachers and students) and likelihood to influence change in student and teacher behaviour. Resources for each module are included to assist teachers to use these ideas in the most appropriate manner in their own class environments.

Learning areas in which spinal health curriculum ideas have been developed include:

- English

- Mathematics
- Health and Physical Education
- Science
- Society and the Environment.

The modules focus on the middle bands according to the SACSA Framework with the emphasis being linked to Standard 4. The SACSA Framework also provides for the inclusion of Key Competencies, skills that underpin the transition from school to work, training and lifelong learning. Where possible, the Key Competencies are identified and incorporated into the specific curriculum unit.

For the purposes of this document the Key Competencies are identified as:
KC1: collecting, analysing and organising information
KC2: communicating ideas and information
KC3: planning and organising activities
KC4: working with others and in teams
KC5: using mathematical ideas and techniques
KC6: solving problems.
KC7: using technology

For each specific curriculum area, the relevant, SACSA links are identified, the standards highlighted and the Key Competencies relevant to the specific tasks addressed.

A model that incorporates all of the concepts outlined above will be followed for each curriculum area. Examples are:

1. **Scope:** Key Ideas Overview – subject specific
2. **Strand:** Concepts to be covered in each area
3. **Standards:** Common reference point for monitoring, judging and reporting on learner achievement.

2. Background to curriculum development

2.1 Spinal pain and disability in our society

Spinal pain is one of the most costly and disabling problems affecting adults in industrialized countries[1,2,3]. Most population-based surveys of back pain report a point prevalence of 15%-30%, a one-year prevalence of 50%, and a lifetime prevalence of 60%-80%[4], which is concerning in terms of loss of productivity, health care costs and personal pain and suffering. Disability from back pain places a significant burden on the individual and their community. In Australia, back problems are the leading specific musculoskeletal cause of health system expenditure, with an estimated total cost of $700 million in 1993-1994[5]. There is some evidence to suggest that back pain experienced in childhood is a risk factor for back pain in later life[6,7], although there are scarce longitudinal studies to support this. It is plausible, however, that implementing strategies to protect the spinal health of children and adolescents should increase their awareness of the problem. Furthermore, by teaching them prevention and self-management strategies, we should assist in reducing the future societal burden of adult back pain. The most accessible environment in which to undertake this education is in schools.

2.2 Spinal pain in adolescents

Adolescents have been repeatedly identified around the world as suffering from spinal pain[9-16]. The repetitive carriage of heavy loads, the poor ergonomic fit of school furniture and the repetitive poor study postures adopted have been hypothesized as potential causes of adolescent spinal pain[12,14]. Our cross-sectional and longitudinal research puts an Australian perspective on this problem[17-27], finding that approximately 50% of adolescents repeatedly report a recent event of spinal pain (neck or low back). Our research has identified strong associates of adolescent low back pain, particularly for young people in the rapid spinal growth years (12-14 years for girls and 13-16 years for boys) with a range of factors including:

a) repeatedly carrying school backpacks weighing over three kilograms,
b) more than 5 hours of sitting (outside school hours),
c) very tall or very short children sitting for any length of time in ‘usual’ school furniture,
d) having an abnormal trunk height to leg length ratio (during growth spurts for boys), and
e) playing high level sport for more than 8 hours per week (for 12-14 year old boys and girls)[17-27].

Thus a range of factors, including the spinal health behaviours of young people in the school environment may well be contributing to adolescent spinal pain.

Despite widespread recognition of the potential for adolescents to be at risk of spinal pain, we can find little information on any validated or evaluated preventative risk management strategy adopted anywhere in the world. The most common approach to addressing adolescent spinal pain is to focus on limiting educational loads. In France, legislation specifies appropriate load carriage by adolescent school students, but there are no penalties for schools or students who do not comply, nor are there school-based education programs to support the legislative requirements[28]. In Hong Kong, Malaysia and Singapore, there are moves to limit school bag sizes to restrict loads carried, but no concurrent

education for teachers or parents to assist in determining appropriate loads. We are concerned that any risk management strategy that did not take a systematic approach, and incorporate a behavioural aspect, may have limited influence on a multifactorial problem.

2.3 What can be done about this problem?

iCAHE research has identified that adolescent spinal pain has many causes. To address this problem, we propose a unique health promotion approach that addresses the concepts of the NH&MRC document on Effective School Health Promotion[8], and utilizes the Health Promoting Schools model[28]. *Health promotion* is defined as 'the combination of educational and environmental supports for actions and conditions of living conducive to health'[30]. The underlying philosophy behind health promotion in schools is that a comprehensive program, rather than curriculum alone, is required to encourage children to adopt health- enhancing behaviours[29,31]. The *Health Promoting Schools* concept is a philosophical approach which advocates the following strategies to improve health[32]:

- **Formal curriculum** This forms the backbone of a school health promotion program, and aims to change knowledge, attitudes and behaviours of individual students, in order to enhance their health. It should provide sufficient information to allow students to make informed choices about their health, and foster the development of a range of skills.
- **School organization, ethos and environment** Schools should contribute to the health of their students through the creation of good management practices, health promoting policies and procedures, and a health-promoting environment. These factors will provide students with the opportunity to apply their learning to the practice of healthy behaviours.
- **Creating partnerships within the school community** Collaborative partnerships between the school and home are integral to successful health promoting schools[8]. When parents and teachers become role models for the messages that are being given through curriculum, health messages are reinforced throughout the school day and at home.

The Health Promoting Schools concept is supported by the World Health Organisation and has been adapted successfully to address a variety of health issues in Australian schools (all of which have multifactorial associates), such as sun care, smoking, wearing bicycle helmets, sexual behaviour etc[32-36]. Such an approach has been shown to produce sustainable changes in student health-enhancing behaviours[32-36].

2.4 What research has iCAHE completed to date?

The iCAHE research team has undertaken a number of activities over the past seven years in relation to the spinal health of school students (*See* **Project Overview.ppt** in **Generic Resources for Teachers**)

Spinal cross- sectional and longitudinal study *(1998- 2004).*

In 1998 the team used a cross-sectional study to investigate events of spinal pain in adolescents aged 12 – 18 years, and identified key contributing factors[17-27] (see **Adolescent posture, spinal pain and backpacks.ppt** in **Science Resources for Teachers folder***).* The findings from this study led to the commencement of a longitudinal study in 1999, in which 144 high school students were measured each year (from first year high school to completion of high school (2003)). The analyses of the longitudinal data to date supports the findings of the cross- sectional study, and highlights the importance of multi-factorial intervention for the adolescent population to reduce events of spinal pain.

Preparation of curriculum and health promotion material *(2001-2003).*

- A spinal health policy document was designed by the iCAHE team and staff from DECS, and formally launched in Adelaide in October 2002 by Hon Trish White, then Minister for Education and Children's Services, SA. The policy advocates awareness of good spinal health behaviours at school organisation, ethos and environment levels, and at the individual student level, to improve the spinal health of adolescents. (see **Spinal Health Policy for School Students.pdf** in **Generic Resources for Teachers**)

- Our work has identified the need for a comprehensive spinal health promotion program to address the issue of spinal pain in high school students. With support from DECS and Adelaide High School, preliminary work was undertaken in 2002-2003, comprising:
  - *Focus groups with teachers, students, and parents* Focus groups were held with these three key stakeholder groups to determine the perceived need for an education program, and to identify its content. Responses from all focus groups supported the need for program and identified a range of issues that could be covered in the curriculum.
  - *Development of curriculum* The draft curriculum was written for students entering first year high school, since our data shows that this is the age of the biggest adolescent growth spurt[17-27], which occurs generally when the student is adapting to a new school environment. Hence, the spine is potentially at its most vulnerable to injury in this stage of early adolescence.

    The curriculum sets out a framework of teaching/learning modules that incorporate the findings of our research. These modules complement the existing school curriculum in five learning areas (English, Mathematics, Health and Physical Education, Society and the Environment, and Science) using the guidelines provided by DECS and the South Australian Curriculum, Standards and Accountability (SACSA) Framework. The suggested lesson material can be taught in 2-3 lessons in each subject area. This resource manual for teachers outlines teaching and learning activities in the curriculum, and includes

examples and resources for each module. Teachers may wish to use the material we have supplied, or use alternative resources and materials to inform student enquiry for the curriculum objectives.

Evaluation of curriculum and health promotion material *(2001-2003).*

We trialled the lessons across the core subjects at Adelaide High School in 2003. Prior to introducing the curriculum into the classroom, we spent time at this school with teachers in each subject area, examining our curriculum ideas and resources, and seeing how teachers turned these ideas into workable lesson plans. We learnt about the flexibility and ingenuity of teachers in interpreting our health messages into teaching and learning outcomes, and we also learnt that as health researchers we had access to a huge range of material that could inform and support the curriculum. There is no 'gold standard' for evaluation of health promotion programs[35-38]. We took a comprehensive approach in evaluating the learning programme, involving both quantitative and qualitative measures, and process, impact and outcome evaluations.

- Process evaluation is the measurement of activities of a program, program quality, and the people that the program is reaching.
- Impact evaluation measures the immediate effect of a program; e.g. does the program meet its' objectives?
- Outcome evaluation measures the long- term effect of a program; e.g. does the program meet its' goals? The curriculum material was evaluated by trailing

We established a spinal health committee at Adelaide High School, consisting of parents, teachers and student representatives. We facilitated a number of meetings of this committee, which discussed opportunities to improve spinal health in the school environment, and barriers to doing so. We presented our work at several staff meetings, so that teachers were well informed of what was happening, and could contribute to the project. We identified several champions for the project, including the school principal (thanks Steve) and a senior Physical Education teacher (thanks Mick), who actively promoted the concepts of good spinal health at every opportunity (school assemblies, year level meetings, staff meetings etc).

We then trialled the program in four Year 8 classes in May 2003, using approximately 100 young people and 7 teachers. We sat in on all lessons using the program, and observed which ideas seemed to work best, and which resources were most useful. We interviewed teachers and students (separately) after the program had been trailed, regarding their perceptions of what worked and what didn't work. We also interviewed the students some six weeks later about what impact the spinal health program had made on them.

Teachers indicated that the resources provided to them were adequate to support their development of lesson plans, and to assist them to provide students with challenges in finding and interpreting information. There appeared to be sufficient challenges in each subject for teachers and students to allow them to pursue specific learning activities that interested them. Teachers also indicated that

they could see opportunities to include spinal health messages in other subjects, and lessons.

The most obvious impact of the program for students was their awareness of what they were carrying in their backpacks, and how much this weighed. We found that they seemed to enjoy learning about researchers and other students' experiences with respect to spinal health (such as in the English newspaper articles) and thinking about their own measurements in the context of the class measurements.

We found the greatest impact on teachers was that participation in the curriculum prompted them to think about their own spinal health (the loads they carried, the furniture they used, the amount of physical activity they undertook related to their spinal health).

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3. Curriculum Matters

3.1 Program Objectives

The core objectives of the program are to raise awareness in students, teachers and their parents of features of good spinal health. Schools have a responsibility to identify issues in the school environment that could constrain good adolescent spinal health, and spinal health program can assist in engaging students, teachers and other school staff in protecting the spinal health of the school community. Specifically these are:

Posture

- To educate students about the anatomy and biomechanics of the spine, related to posture
- To educate students about, and have them practice, good spinal posture in a variety of positions (sitting, standing, etc.) and whilst undertaking a variety of activities (lifting, bending etc)
- To teach students about the potential long-term consequences of poor posture, and why it is important to maintain good posture for spinal health
- To demonstrate the effect of load carriage on posture
- To equip students with an ability to recognise and analyse good and poor posture
- To teach students about posture and furniture, and how to choose correct furniture
- To encourage an awareness of the need to demonstrate good back care skills in the workplace, home and community as well as at school

Load carriage

- To teach students basic load carriage principles, including:
    - Minimising the weight of loads carried
    - The use of different types of backpacks
    - Fitting backpacks correctly:
        - Adjust shoulder straps so top of bag sits beneath the shoulder
        - The bottom of the bag should sit at the level of the waist (not hips)
        - The bag should sit firmly against the student's back
- To encourage students to analyse the contents of their loads and determine the essential and non-essential items
- To increase students' awareness of the spinal health risks of carrying heavy loads and using backpacks in an incorrect manner
- To guide students in making load carriage recommendations (at an individual level, and at a school-wide level) to assist in protecting their spinal health
- Improving use of lockers

Physical Activity

- To improve students' awareness of the aspects of health (physical fitness being one)
- To teach students about the components of physical fitness, and to measure these
- To teach students about the life-long connection between health, physical fitness and spinal health

- To encourage students to maintain a fit and healthy lifestyle

Impact of individual and society

- To improve students' awareness of the impact of spinal pain on the individual
- To lead students to consider the impact of poor spinal health from global, local economic, legal and social perspectives
- To teach students to consider spinal health in their own workplaces (school, home, community employment)
- To encourage students to be aware of occupational health and safety legislation and how it applies to them.

3.2 Methods of assessing curriculum impact

- Knowledge tests
- Observed behaviours
- Changes in attitudes to causes of poor posture and poor spinal health (such as load carriage, locker use, furniture choice and use etc)
- Whole of school decisions regarding good spinal health strategies

3.3 Recommended supports required for curriculum uptake

A number of strategies are suggested in the literature to support a whole of school approach when promoting health issues. Most important is the formation of a school 'spinal health' team consisting of parent, student and teacher representatives to assist in the formulation and dissemination of spinal health messages throughout the school. A 'champion' works well (for example teacher-advocate, sports star etc) who provides overt support throughout the school for good spinal health practices. Establishing a regular section in the school newsletter for spinal health stories from students and teachers keeps spinal health messages at the forefront of the school community's awareness, as do regular reports at School Assemblies on school spinal health activities.

3.4 Matrix of activities and outcomes

	Additional activities	Help the teacher may need	Project outcomes addressed	Proposed outcomes
Mathematics	• How backpack is packed • Differences between backpacks in carrying loads	• Designing questionnaires • Using MS Excel • Evaluation of backpack designs	• Attitudes and knowledge of loads • Choice of backpacks	• Reduction in school bag weights • Better locker use • More informed choice of backpacks
Science	• Assessing ergonomics of common furniture, mattresses, pillows	• Designing short experiments on the effect of different forces on posture	• Better understanding of posture under different situations	• Better posture • Better choice and use of furniture
Society and Environment	• Evaluation of student 'workspaces' • Discussion on classroom design • Safety in school environment (kitchen, labs etc) • How to set up home study environments	• An understanding of ergonomics and occupational health and safety principles	• Knowledge of safety • Knowledge of occupational risks related to spinal health	• Safer use of the environment • Greater awareness of disability
English	• Discussion on knowledge transference within the school environment		• Attitudes and knowledge of posture and what influences it	• Students becoming active in the school environment in changing risks to spinal health
Physical Education	• Exercises to improve posture • First aid to manage back pain • Information on nutrition	• Improved knowledge of spinal health exercises and management of pain • Greater knowledge about nutrition	• How to care for your back • Good daily exercise habits • Good daily food habits	• Improved posture • Improved use of furniture • Improved knowledge of diets

3.6 How to use this manual

This manual provides information and resources for five core subjects in first year high school (Mathematics, English, Science, Health and Physical Education (two units) and Society and Environment).

There is a separate section for each subject, which outlines the scope of the unit, the standards by which it could be evaluated using the SACSA framework, specific objectives of the unit, an overview of key ideas (including the relevant strand) , information required to complete the unit, suggested units of work and tasks related to each objective and resources for teachers. Teachers are encouraged to use the ideas and resources to make up their own lesson plans, relevant to the school community, the school environment and the teaching and learning opportunities in middle schooling.

Tasks could be undertaken as a class ©, in small groups (SG), or by individuals (I). Ideas of how the tasks could be undertaken are provided in the manual.

Generic Resources for Teachers

Additional references to support curriculum

http://www.childrenspine.us/
http://www.alphacenter.ucr.edu/Brochures/HBHM_Brochure.pdf
http://www.brainpop.com/
http://www.working-well.org/kidstation.html
http://www.spinosaurus.com.au/
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Resource manual for curriculum for first year high school students:
Developing good lifelong spinal health behaviors

To be used at teachers' discretion and in conjunction with the Additional Material

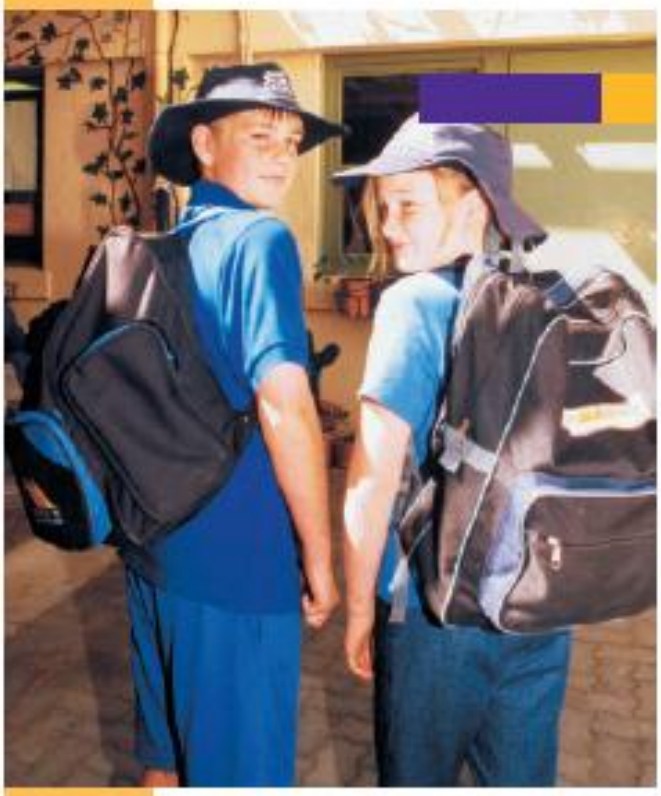
Spinal health for South Australian students

This brochure flags the commencement of a unique initiative between the Centre for Allied Health Research, University of South Australia and the Department of Education, training and Employment in recognising the importance of spinal health in school communities. Whilst this brochure focuses on adolescents the importance of spinal health for teachers and support staff is also acknowledged.

Research undertaken by the Centre for Allied Health Research, University of South Australia (USA), in consultation with the Department of Education, Training and Employment, has given specific indicators for safe practice in relation to spinal health care in schools. The research gives specific direction in relation to:

- Posture
- Use of computers
- Load carrying
- Locker use
- Physical activity.

The research focused on adolescence – a period when the spine is still developing and students are increasing their take-home study materials – and potentially carrying greater loads.



Support for local implementation of the guidelines is available from the Centre for Allied Health Research, University of South Australia, by specific request. Site specific assessments of the school environment can be provided. Further information can be obtained from the Centre Website (www.unisa.edu.au/alliedhealth)

THE CENTRE FOR ALLIED HEALTH RESEARCH, UNIVERSITY OF SOUTH AUSTRALIA

The Centre for Allied Health Research comprises researchers in the fields of physiotherapy, podiatry, medical radiation and occupational therapy. It has long standing and major research interests in adolescent spinal health. The centre is known for efficient and successful completion of practical community-focused research, and for its commitment to educating clinicians on evidence-based practice including spinal health care and health promotion. Centre researchers enjoy strong ongoing links with industry and government bodies. Research into adolescent spinal health commenced in 1997 and is ongoing. Centre researchers regularly publish in strategic and high quality national and international journals, and consequently, the Centre is becoming recognised as the pre-eminent place for evidence-based allied health/ public health research in Australia.

Department of Education Training and Employment

Supporting school communities to become spinal health promoting environments

LOAD CARRYING

Excessive loads are linked to poor posture. Schools have a responsibility to seek strategies to minimise loads carried, and to educate young people about good load carrying practices.

- The load should not significantly change young people's posture from both a side and front view.
- Backpacks worn over two shoulders are the best form of load carriage.
- There is a limit to how much weight can be carried in a backpack. Research shows that, where possible, backpack weights should be less than 10% of body weight. Less than 10% of average weight equates to:

  3.9 kgs for 12-13 year olds

  4.3 kgs for 14-15 year olds

  4.8 kgs for 16-17 year olds.

  This weight should be viewed in practical terms and represents, for instance, three medium to large textbooks and a lunch box.
- Young people should be encouraged to remove their backpacks and rest the pack on the ground when standing for long periods of time.
- Young people should not be encouraged to ride bicycles while carrying a backpack unless they have a waist strap that securely fastens the load to the body.
- Young people should be alerted to the risks entailed by carrying large and overloaded backpacks. These risks are both to themselves (overbalancing, injuring spine and shoulder joint), and to others (being hit by the backpack on public transport, having a backpack fall on them if insecurely fastened).
- Often young people need to carry other items (musical instruments, sporting gear) as well as their backpacks. Care should be taken to restrict the carrying time and the total amount of weight carried.
- If young people are regularly carrying a laptop, encourage them to check the total weight carried. Where possible, the laptop should be carried in the backpack, as close to the body as possible. This will necessarily restrict the remainder of the load.

LOCKER USE

- Young people should be encouraged to view locker use as an aid to reducing loads, not as an imposition.
- Young people should be involved in determining locker choice and situation.
- Lockers should be secure.
- Lockers should:

  be appropriately sized to hold the entire school bag

  suit the users' height and arm reach

  be positioned as close to class rooms as possible
- Young people should be taught to use lockers safely by:

  rationalising the loads they need for each lesson

  determining the best pattern of locker use for them (to suit lessons and class rooms).

GUIDELINES FOR SCHOOL COMMUNITIES

It is acknowledged that student health is primarily a personal and family responsibility, and what students carry in their school bags is often a matter of student choice. The following guidelines are provided to assist school communities to work together over time to create a physical and working environment, which is supportive of student spinal health.

POSTURE

Research shows that up to 25% of any school class will be suffering low back pain or neck pain at any one time. This may be related to posture.

- Students should be encouraged to stand and sit well, and to be responsible for their own bodies. Students who regularly report neck pain or headaches should be encouraged to pursue eye sight testing to rule out potential causes.
- Young people should be encouraged to stand tall, with shoulders aligned over hips, and with weight evenly over both feet.
- When sitting, young people should be encouraged to use the back support of their chair, with their feet resting on the ground.
- It is possible that school seating may be too small for some students, and too large for others. Where possible the purchase of different sizes of furniture should be encouraged and classrooms should try to offer a choice of furniture in classrooms where a range of year groups work.
- Furniture should be purchased with the end-use in mind. Tables and benches at which students will be required to sit should have sufficient leg space underneath to allow the student to sit in a forward facing, symmetrical posture.
- School room lighting should enable young people sitting at the back of the room to view objects at the front of the room with ease. Be wary of the influence of glare from direct sunlight, or reflected off shiny surfaces (i.e. computer screens). Teachers should be sensitive to the potential effects of glare throughout the school day. Glare can cause students' eye strain, headaches and awkward postures whilst at their desks.

COMPUTING

Spinal health should be a consideration in computer setup and use.

- When using desk top computers young people should be encouraged to place the keyboard at elbow height whilst sitting in an upright posture.
- The top of the screen should be at eye level.
- When using computer mouse devices the elbow should be kept in by the side of the body and the mouse kept as close to the body as possible.
- The screen should be maintained at a distance of approximately 50-60 cm from the eyes.
- Young people should be encouraged to plan work away from the computer, to minimise time spent at the computer console.
- When using a properly set up desk mounted personal computer (PC), young people should be encouraged to have five minutes break every hour. During these breaks they should be encouraged to leave the desk and move around.

Prolonged use of laptops is not ideal for the spinal health of students. Their usefulness is often restricted by screens that are too small or badly lit, and keyboards that are not appropriately sized. Regular use of laptops requires attention to the correct height of desks and chairs (to address the issues raised above), and to the arrangement of power cords for occupational health and safety reasons.

- When using laptop computers for extended periods of time, young people should be encouraged to have five minute breaks every 30 minutes of constant computer use. During these breaks young people should be encouraged to leave the desk and move around. It is also good practice to move the shoulders, arms and head to relieve postural tension.
- When selecting laptops for young people choose the lightest, and the one with the largest screen.
- With the high use of computers in the home environment students should be educated in the importance of correct workstation setup both at home and at school.

Supporting school communities to become spinal health promoting environments

SPINAL HEALTH FOR YOUNG AUSTRALIANS

"Up to 40% of adult Australians suffer repeated episodes of back pain, resulting in days off work"

"Over 80% of adult Australians will suffer disabling back pain at least once in their lifetime"

Experts believe that causes of adult back pain may be set up in the growing years

Supporting school communities to become spinal health promoting environments

University of South Australia

Child and Adolescent Spinal Health

Professor Karen Grimmer-Somers

Representing
International Centre for Allied Health Evidence Spinal Health Team
University of South Australia

Acknowledging the financial support of the Financial Markets Foundation for children

iCAHE
International Centre for Allied Health Evidence

Involving to date.....

- Over 3400 young South Australians aged 5-18 years
- Over 800 final year physiotherapy students as project officers
- 6 Masters of Physiotherapy students
- 3 PhD students

International Centre for Allied Health Evidence

Occupational health and safety

- Occupational spinal health for school teachers and students over 18 years, in schools, is protected by legislation
  - Loads
  - Furniture
  - Lifting
  - Hazard identification and reduction
- No legislation protecting occupational spinal health issues in schools for students < 18 years
  - 'Work experience' provides limited exposure and legislation protection

International Centre for Allied Health Evidence

Our underlying questions

- Is there really an issue with child and adolescent spinal pain?
- Is any pain acceptable?
  - Is pain part of growing?
- Does exposure to adolescent spinal pain increase likelihood of adult spinal pain?

International Centre for Allied Health Evidence

International debate

- Is heavy load carriage good for growing spines?
  - If so, how much load is sufficient?
- International arguments around bony growth, prevention of osteoporosis, development of muscle strength/ endurance vs repetitive loading causing cumulative micro-damage

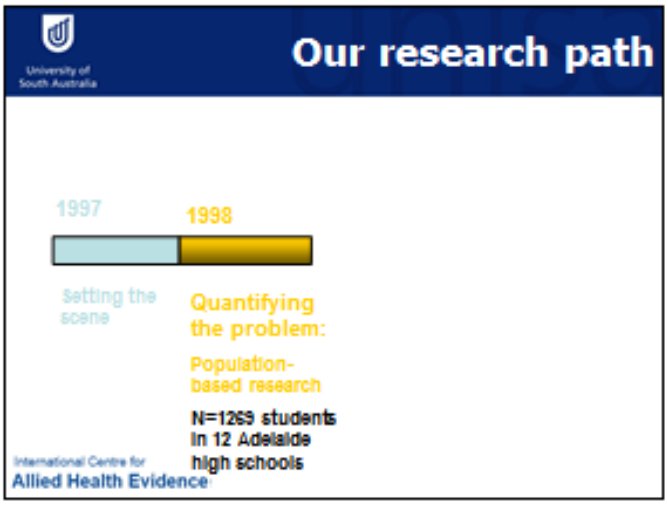
International Centre for Allied Health Evidence

Our research aims

- To describe the frequency of child & adolescent spinal pain
  - To understand its causes
- To identify whether adolescent pain becomes adult spinal pain
- To understand and influence the 'systems' influencing good child – adolescent spinal health

International Centre for Allied Health Evidence


Our research path
1997
Setting the scene
focus groups, surveys, lab-based pilot studies
International Centre for
Allied Health Evidence


Our research path
1997
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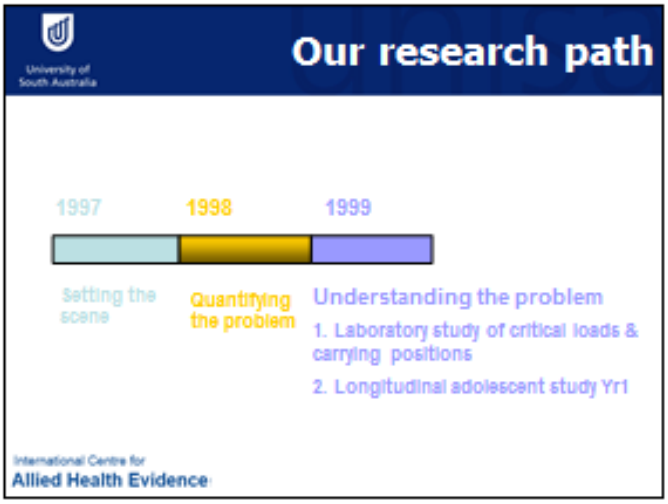
Setting the scene
Quantifying the problem:
Population-based research
N=1269 students in 12 Adelaide high schools
International Centre for
Allied Health Evidence


Our research path
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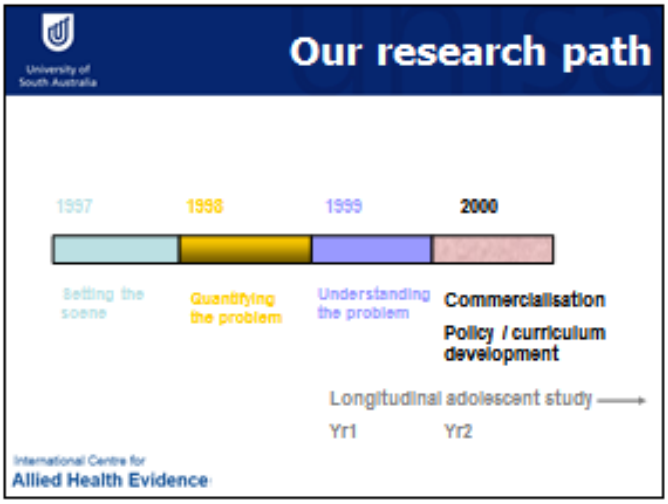
Quantifying the problem
Understanding the problem
1. Laboratory study of critical loads & carrying positions
2. Longitudinal adolescent study Yr1
International Centre for
Allied Health Evidence


Our research path
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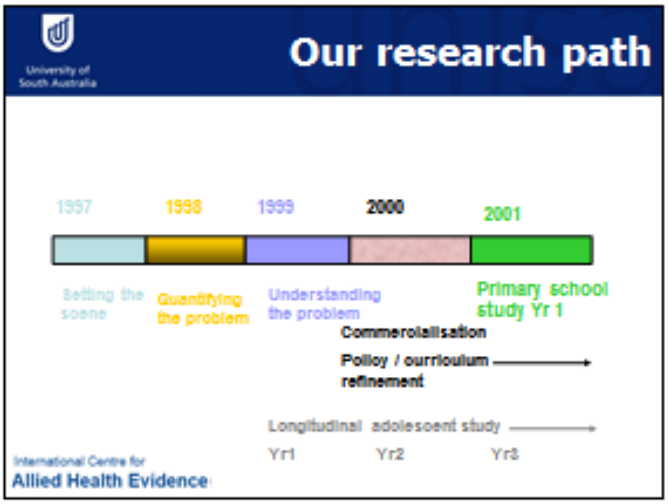
Understanding the problem
Commercialisation
Policy / curriculum development
Longitudinal adolescent study
Yr1
Yr2
International Centre for
Allied Health Evidence


Our research path
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Quantifying the problem
Understanding the problem
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Commercialisation
Policy / curriculum refinement
Longitudinal adolescent study
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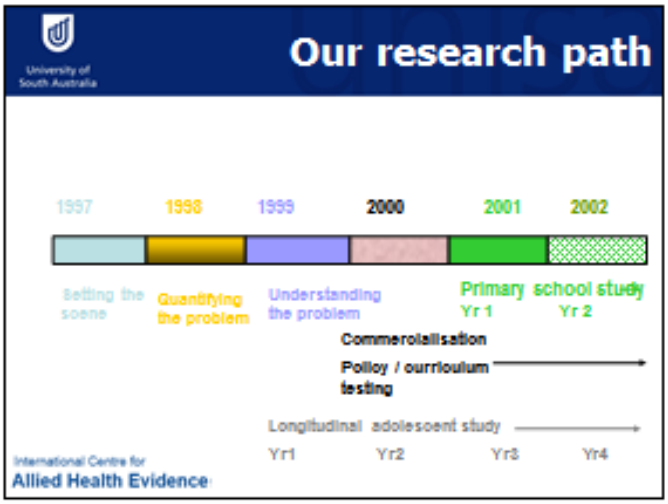
Yr2
Yr3
International Centre for
Allied Health Evidence


Our research path
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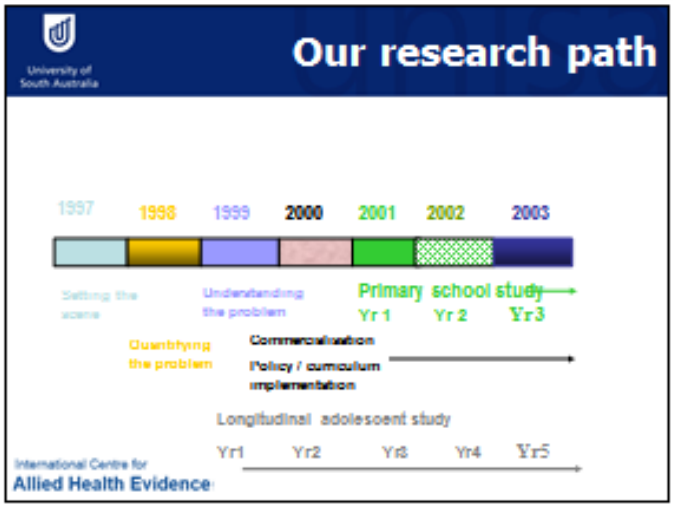
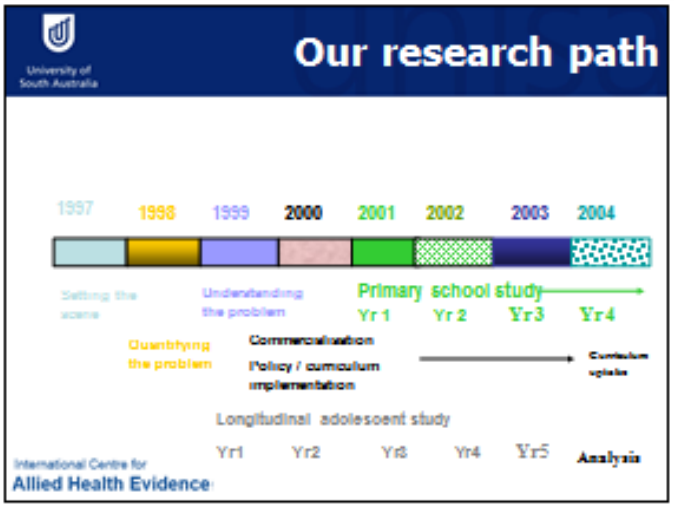
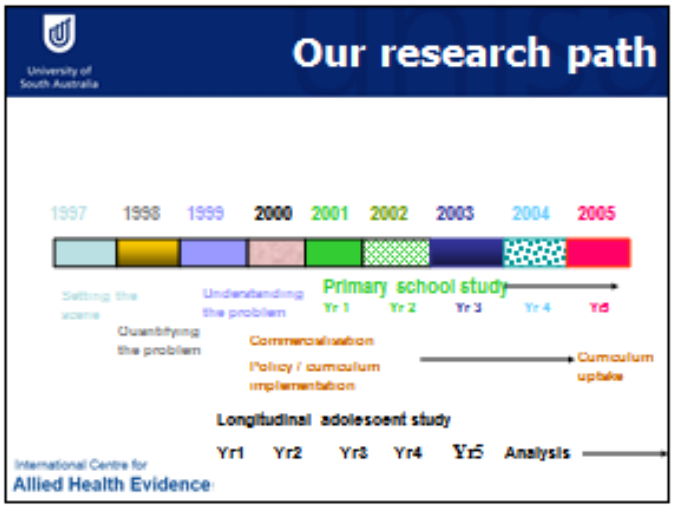
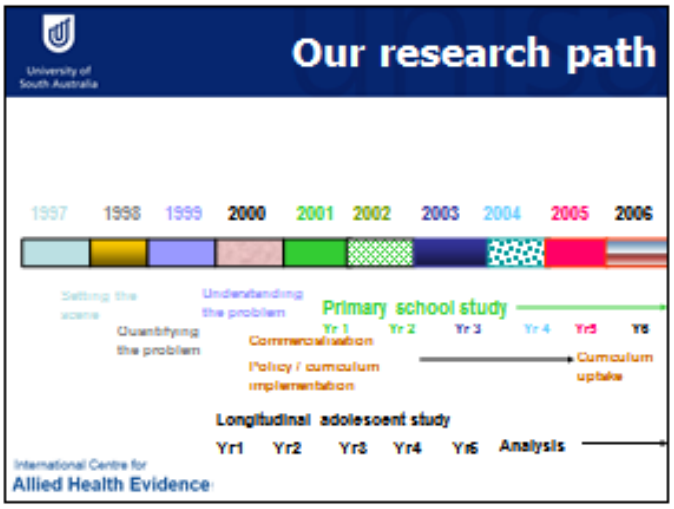
Setting the scene
Quantifying the problem
Understanding the problem
Primary school study
Yr 1
Yr 2
Commercialisation
Policy / curriculum testing
Longitudinal adolescent study
Yr1
Yr2
Yr3
Yr4
International Centre for
Allied Health Evidence

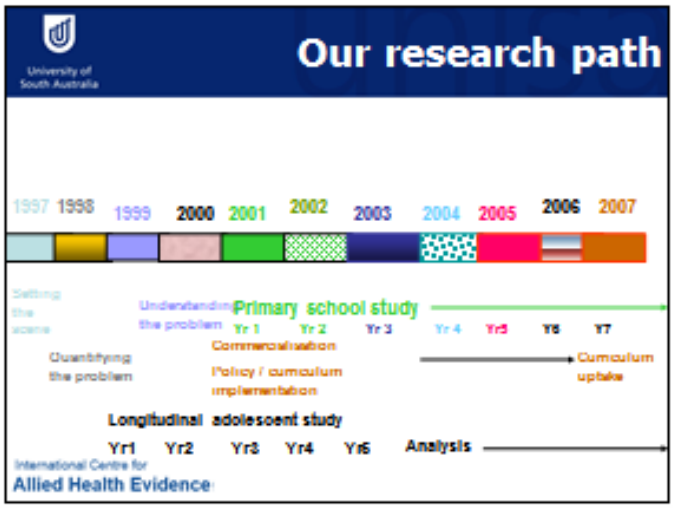
Resource manual for curriculum for first year high school students:
Developing good lifelong spinal health behaviors

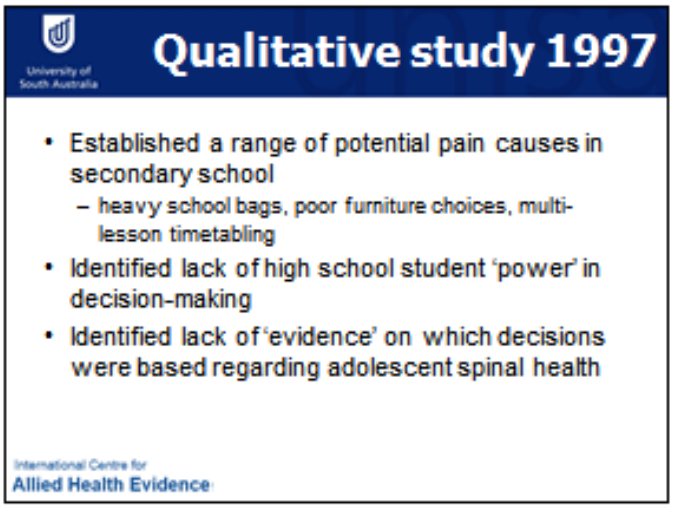












To be used at teachers' discretion and in conjunction with the Additional Material

Cross-sectional study 1998

- We measured 1239 students aged 12-18 years in 12 high schools
  - Posture (with & without school bag)
  - Questionnaire
    - Spinal pain
    - Recreational activities
    - Use of school and home furniture
  - School bag weight & dimensions
  - Anthropometry

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Cross-sectional findings

- 15% Year 8 students report spinal pain
  - Why?
- Girls' spinal pain increases by approx 20% each year (from Year 8)
- Boys spinal pain increases by approx 10% each year (from Year 8)
  - Approx. twice as many girls as boys report regular spinal pain
- Anthropometric & environmental predictors of boys' pain are more readily identifiable than for girls

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Spinal pain is associated with

- 'forward' head on neck posture (boys & girls)
- long legs relative to trunk height (boys)
- backpack loads > 3.7 kgs (boys > girls)
- sport participation in early adolescence (boys & girls)
- being very tall or very short, and sitting > 4 hours/ day (boys and girls)
- carrying a backpack for more than one hour per day (cumulative) (boys & girls)
- imbalanced muscle control around the trunk (boys & girls)

International Centre for Allied Health Evidence

Issues with inferring causality from cross-sectional studies

- Measures of exposure and disease at only one point in time
  - 'Association' can be determined, not 'cause'
  - *Key question*: Are the year 12 students in a CSS equivalent to the Year 8 students in a CSS if they were to be measured again in 5 years' time?
  - CSS provides a proxy longitudinal measure
    - measures different aged students at the one time point, not the same students at different time points

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Posture change from wearing backpacks: Laboratory study 1999 & Physiopak development

Experiment to test the effect of bag weight and wearing position on standing posture

iCAHE International Centre for Allied Health Evidence

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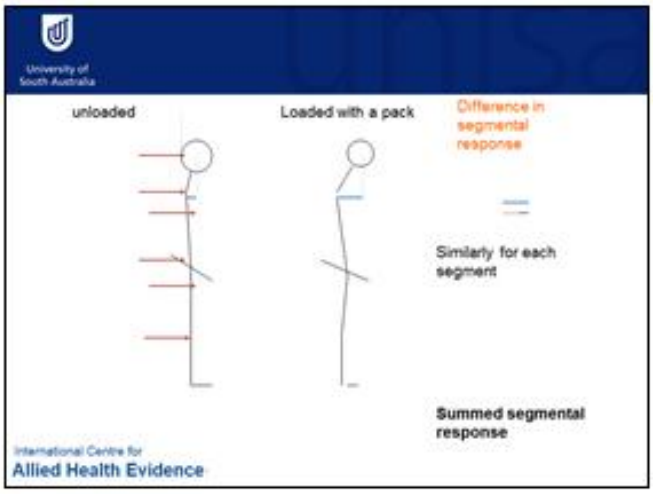
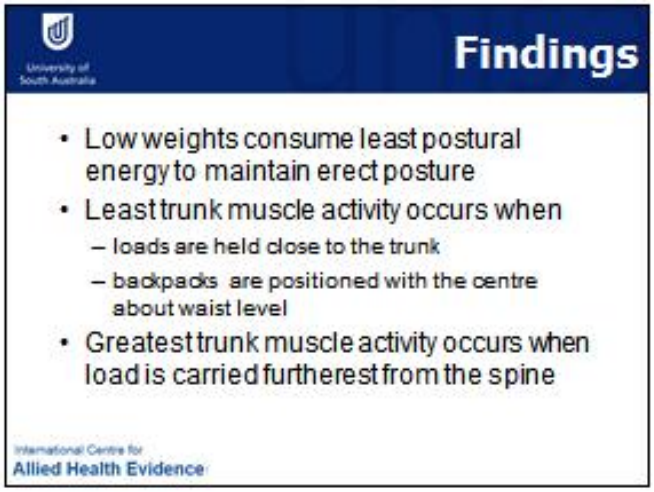
University of South Australia
International Centre for
Allied Health Evidence


University of South Australia
unloaded
Loaded with a pack
Difference in segmental response
Similarly for each segment
Summed segmental response
International Centre for
Allied Health Evidence


University of South Australia
Findings
• Low weights consume least postural energy to maintain erect posture
• Least trunk muscle activity occurs when
– loads are held close to the trunk
– backpacks are positioned with the centre about waist level
• Greatest trunk muscle activity occurs when load is carried furtherest from the spine
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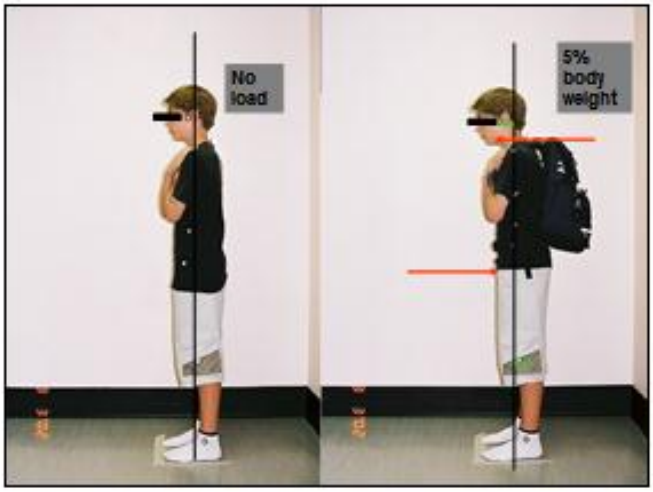
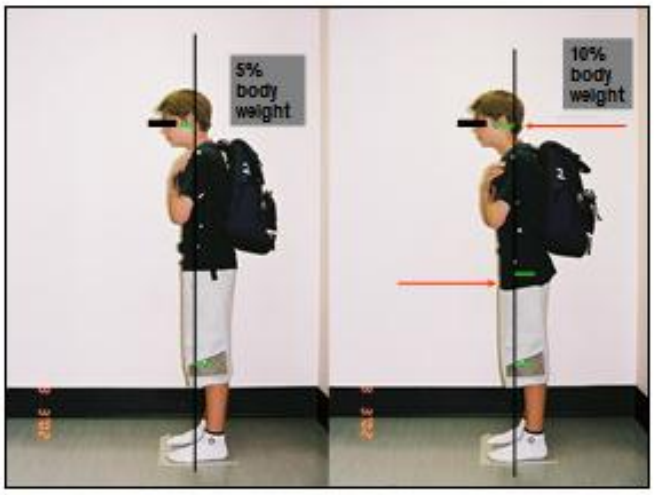
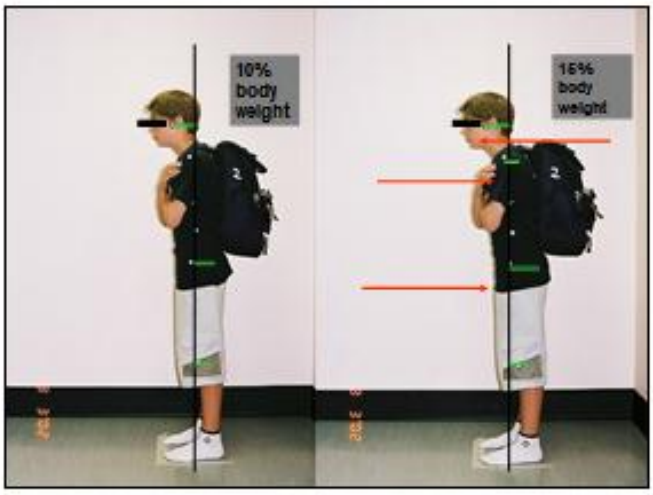
Allied Health Evidence


No load
5% body weight


5% body weight
10% body weight


10% body weight
15% body weight

Progressive & linear deviation from postural 'norm'

5% body weight

10% body weight

15% body weight

International Centre for Allied Health Evidence

Longitudinal high school study

- Commenced 1999, completed 2003
  - 538 Yr 8 students invited to participate
    - 435 participated in 1999 (82.3% invited students)
      - 315 participated in 2000 (Yr 9) (72% 1999 cohort)
      - 298 participated in 2001 (Yr 10) (68% 1999 cohort)
      - 242 participating in 2002 (Yr 11) (46% 1999 cohort)
      - 174 participating in 2003 (Yr 12) (40% 1999 cohort)

International Centre for Allied Health Evidence

Measures

- Anthropometry
- Muscle performance
- Motor control / planning
- Standing posture
- School bag weight & dimensions
- Questionnaire about the student

International Centre for Allied Health Evidence

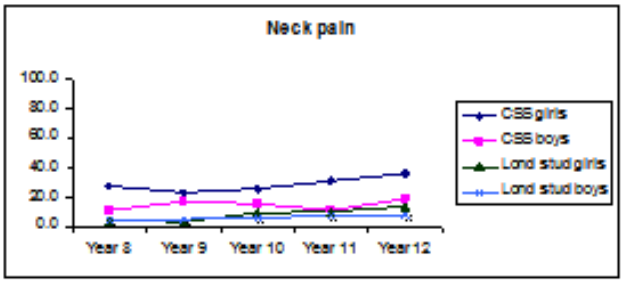
Comparing cross-sectional and longitudinal data sets

iCAHE International Centre for Allied Health Evidence

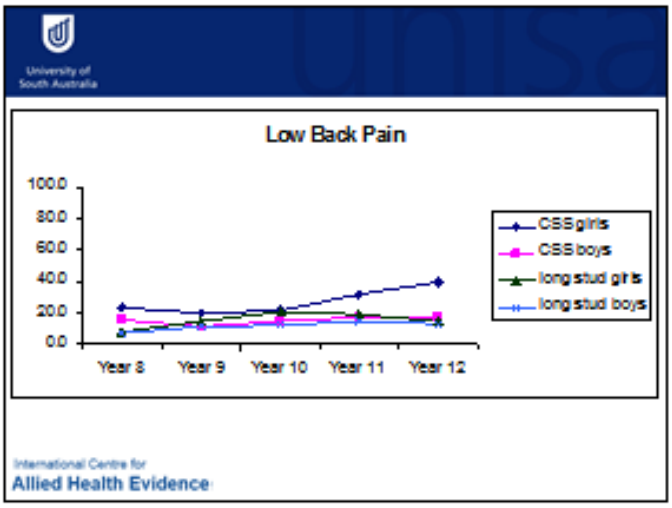
Validation of other work

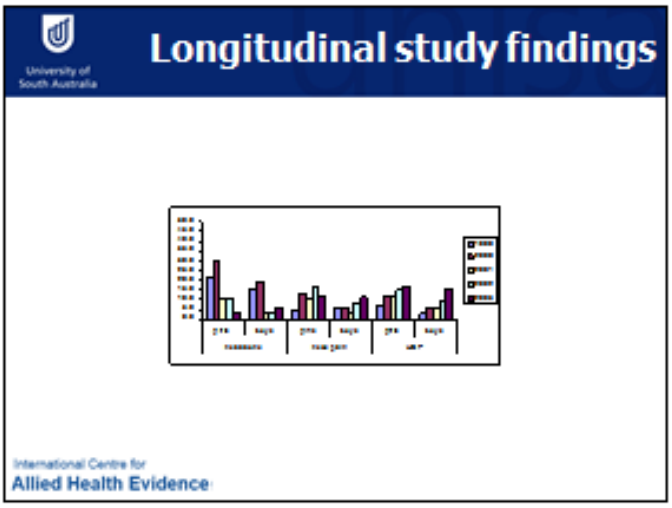
- Our longitudinal data validates our 1998 cross-sectional data
- Girls' growth spurt is well underway by entry into high school (12-13 years) and slows significantly by age 14-15 years
- Boys' growth spurt commences at 13-14 years and continues linearly …….

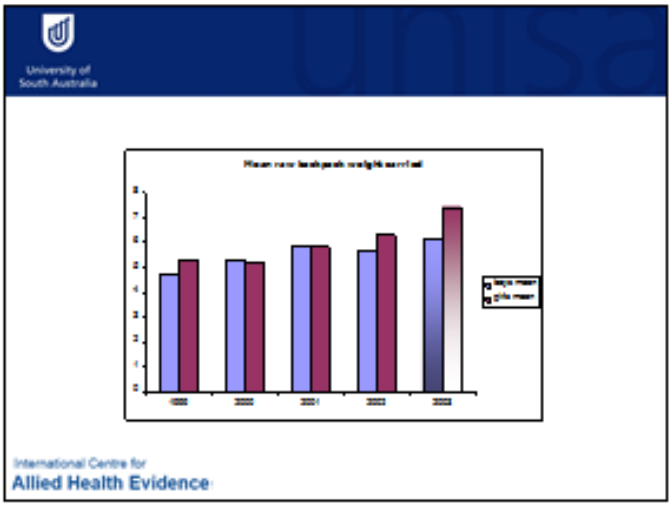
International Centre for Allied Health Evidence



International Centre for Allied Health Evidence


Low Back Pain
100.0
80.0
60.0
40.0
20.0
0.0
Year 8
Year 9
Year 10
Year 11
Year 12
CSS girls
CSS boys
long stud girls
long stud boys
International Centre for
Allied Health Evidence


Longitudinal study findings
International Centre for
Allied Health Evidence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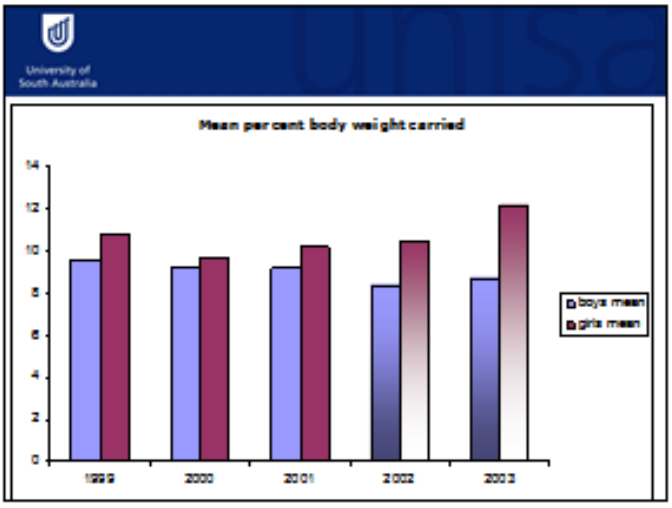
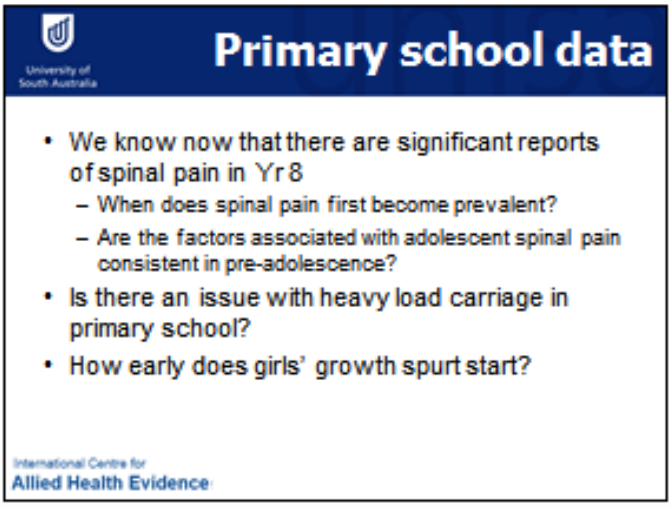

Mean per cent body weight carried
14
12
10
8
6
4
2
0
1999
2000
2001
2002
2003
boys mean
girls mean


Bag weight and spinal pain
• Increasing reports of low back pain are associated with heavier backpack weights
• Headache in Year 8 leads to reports of neck and upper back pain in older grades
– Some association with heavy backpack weights in Year 8 and 9
• Cumulative effect???
International Centre for
Allied Health Evidence


Primary school data
• We know now that there are significant reports of spinal pain in Yr 8
– When does spinal pain first become prevalent?
– Are the factors associated with adolescent spinal pain consistent in pre-adolescence?
• Is there an issue with heavy load carriage in primary school?
• How early does girls' growth spurt start?
International Centre for
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University of South Australia

Collecting longitudinal data from primary schools

iCAHE
International Centre for Allied Health Evidence

Student numbers

- 2001 336 students
  - R to Yr7
- 2002 266 students
  - Yr1 to Yr7
- 2003 187 students
  - Yr2 to Yr7
- 2004 211 students
  - Yr3 to Yr7
- 2005 120 students
  - Y4 to Yr 7
- 2006 81 students
  - Y5 to Y7
- 2007 ??70 students
  - Y6 to Yr 7

Representative sample of 'usual' children in terms of socioeconomic status, ethnicity

International Centre for Allied Health Evidence

School bag weight (kgs)

Grade	Mean	SD	Min	Max
R	2.6	0.8	1.3	5.5
1	2.3	0.7	0.6	4.4
2	2.4	1.1	0.7	6.5
3	2.6	0.9	0.9	6.2
4	2.3	1.4	1.3	5.6
5	2.6	1.7	1.3	12.3
6	2.6	0.9	0.9	6.4
7	2.4	1.2	0.7	7.1
8	5.7	2.8	1.2	10.5
9	5.5	1.7	0.6	12.5
10	5.4	2.2	0.7	15.6

International Centre for Allied Health Evidence

Percent body weight carried

Grade	Mean	SD	Min	Max
R	8.7	2.7	3.5	14.2
1	7.5	2.7	2.7	14.3
2	7.9	2.9	3.2	16.6
3	8.3	3.5	3.1	22.7
4	7.3	4.2	3.7	16.2
5	8.4	6.9	3.8	52.2
6	7.5	2.9	2.6	15.2
7	7.1	3.7	2.3	17.3
8	10.7	3.7	3.5	18.2
9	9.5	2.7	2.2	16.3
10	9.9	2.2	3.2	16.9

International Centre for Allied Health Evidence

Girls' growth spurt

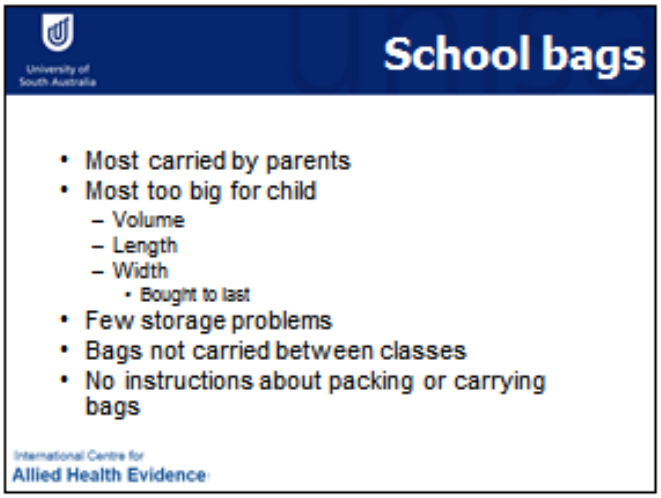
- Starts variably from age 10 years
- Well established before entry into high school for approx 65% girls in sample
  - precedes menarche
  - puts girls most at risk for extrinsic influences on spine
    - heavy load carriage
    - poor posture
    - poor environment (furniture etc)

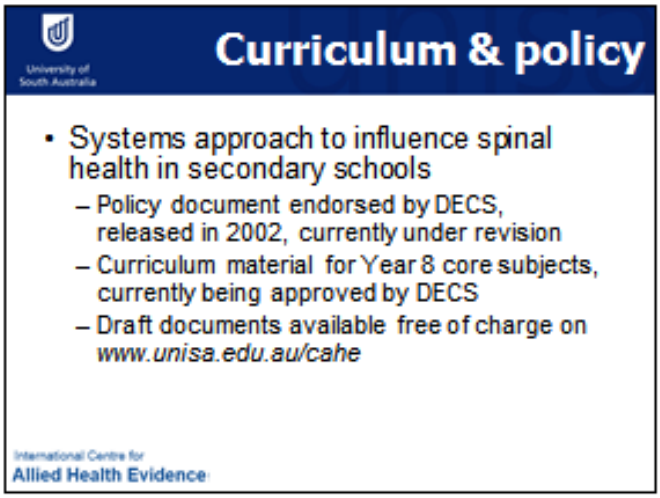
International Centre for Allied Health Evidence

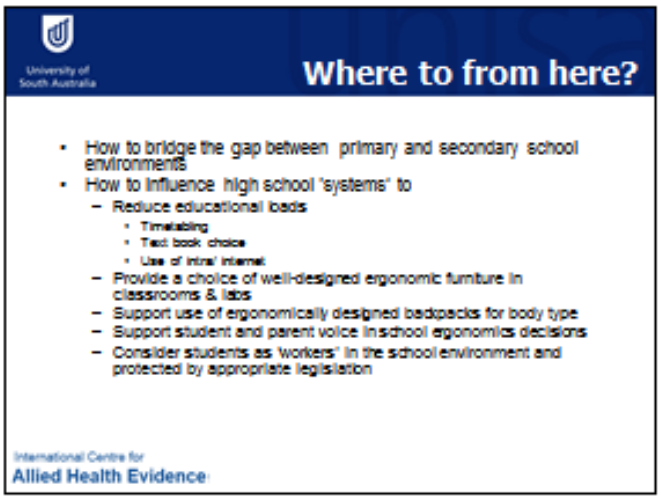
Spinal pain

- Low prevalence
  - <1% in Grades R-3
  - 2% in Grades 4-5
  - 3% in Grades 5-6
  - 5-7% in Grade 7
  - 15%+ in Grade 8 ----
- Primary school pain
  - Not related to school bag weight
  - Not related to posture

International Centre for Allied Health Evidence


University of South Australia
School bags
• Most carried by parents
• Most too big for child
– Volume
– Length
– Width
• Bought to last
• Few storage problems
• Bags not carried between classes
• No instructions about packing or carrying bags
International Centre for
Allied Health Evidence


University of South Australia
Curriculum & policy
• Systems approach to influence spinal health in secondary schools
– Policy document endorsed by DECS, released in 2002, currently under revision
– Curriculum material for Year 8 core subjects, currently being approved by DECS
– Draft documents available free of charge on www.unisa.edu.au/cahe
International Centre for
Allied Health Evidence


University of South Australia
Where to from here?
• How to bridge the gap between primary and secondary school environments
• How to influence high school 'systems' to
– Reduce educational loads
• Timetabling
• Text book choice
• Use of intra/ internet
– Provide a choice of well-designed ergonomic furniture in classrooms & labs
– Support use of ergonomically designed backpacks for body type
– Support student and parent voice in school ergonomics decisions
– Consider students as 'workers' in the school environment and protected by appropriate legislation
International Centre for
Allied Health Evidence

4. MATHEMATICS

This unit of work addresses all three scope key ideas in the 'Exploring, analysing and modelling data' strand of the Mathematics learning area, as given in the SACSA framework, which are:

- Students engage with data by formulating and answering questions, and collecting, organising and representing data in order to investigate and understand the world around them. **In. T. C.** KC2. KC6
- Students use statistical methods to reduce, analyse and interpret data, while critically evaluating the cultural and social exclusivity of the samples used. **In. T.** KC1
- Students engage with data to understand, analyse and apply notion of chance and probability in the social and natural worlds. **F. In. T.** KC1

This unit of work can be evaluated using the Standard 4 outcomes provided in the SACSA framework.

STANDARD 4

4.1 The student poses questions, appropriately designs a survey, collects data and classifies sequence, collapses, tabulates and represents the data with and without ICTs

KC1, KC2, KC7

4.2 The student reads and describes information in given tables, diagrams, line and bar graphs. Makes predictions based on the information, understanding the limitations of data interpretation and the possible social consequences of these limitations.

KC2, KC6

4.1 Specific Objectives

1. To heighten student awareness of their load carrying habits (bag weight, choice of bag, style of carriage e.g. one shoulder or two)
2. To allow students to reflect on the impact that load carriage habits may have on spinal health
3. To guide students to make load carriage recommendations which could be readily implemented by themselves, or discussed further with school management

4.2 Key ideas overview

Strand: Exploring, analysing and modelling data

In this strand students will experience the use of descriptive and predictive data that will enable them to explore, analyse and engage with social and environmental issues that are important to them and their communities. Students engage with data by formulating and answering questions, and collecting, organising and representing data in order to investigate and understand the world around them.

For the purpose of the Mathematics unit, students will be asked to perform a number of tasks that will require them to:

- design a survey
- collect data
- graphically represent the data

- compare the information collected with data from the Centre for Allied Health Evidence (using published data and research papers), and
- suggest possible solutions to research questions

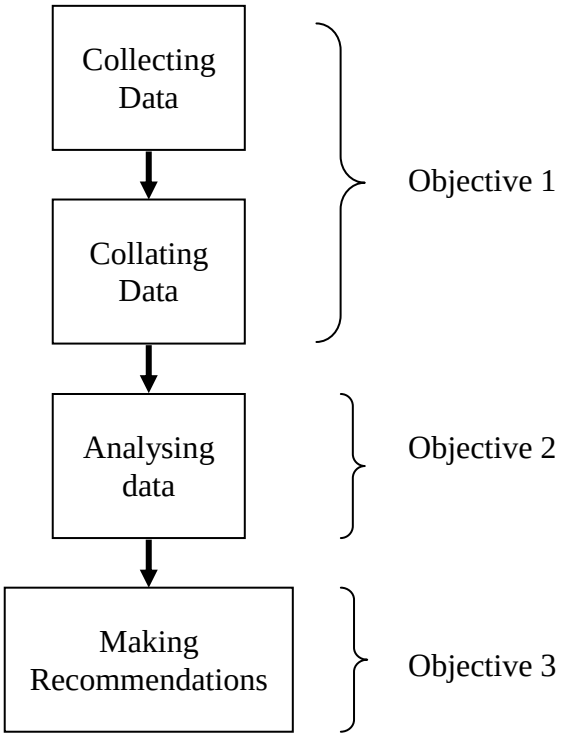
4.3 Information required to complete the unit

Students could collect data from students in their own mathematics class. At the completion of the unit they could compare their findings with other classes' results. Issues that could be addressed include:

- Use of backpacks – how many students carry them?
- What brand and design are they?
- How do they differ?
- What weight are they on consecutive days over a week?
  - Bags could be weighed daily, or at the beginning of each mathematics lesson in a one week period) to obtain an average weight across a one week period
- The body weight of each student in the class and the percentage body weight carried in backpacks each day to school
- The number of times per week that a school bag is brought to school
- The mode of transport to and from school
- The contents of the school bag each day
- What happens to the school bag during the day? Is it carried with students, left in a locker etc.
- What percentage of the school day do you carry your school bag?
- Experiences of spinal pain

4.4 Unit relationships and organisation

The units in this section are organised to allow students to follow a research programme, from collecting data through to making recommendations



4.5 Suggested units of work/tasks

Objective 1: ***To heighten student awareness of their load carriage habits and other behaviours which could affect spinal health***

Students should consider the following questions:

- What is the mean weight of my school bag at the start of the school day?
- What is my body weight?
- What percentage of my body weight is my backpack?
- What type of school bag do I use?
- What features of the bag do I use?
- How do I carry my school bag?
- How long do I spend sitting each day?
- How often do I use my locker?
- How often do I get spinal pain?

Students should reflect on the answers to these questions from an individual perspective and the perspective of their entire class.

Tasks

1. Students should **design a survey** to collect information on load carriage habits **[SG].** The survey should collect information on:

- The type of bag used (e.g. backpack/ one- strapped bag/ bag with wheels)
- How often students use features of their bag (e.g. waist belts/ chest straps)
- How long the bag is carried each day (minutes)
- How the bag is most frequently carried (e.g. over two shoulders/ over one shoulder)
- Whether a locker is used, and, if so, how frequently (no of times per day)
- How many hours/ day are spent sitting
- How often back pain is experienced (days per week/month/year)

Students could develop their own survey, or they could use a survey already designed by the International Centre for Allied Health Evidence (iCAHE) could be used (see ***Backpack questionnaire.doc*** in **Mathematics Resources for Teachers section**) This survey has been tested and found to be a reliable and valid measurement tool to collect information on load carriage habits from High School students.

The survey could be delivered once only, or sections of it could be delivered every day for a school week to look at variability.

2. Complete the survey [I]. Each child in the class should fill in the survey. They should also measure their bag weight and their own weight, using scales. Students should decide how to measure their school bag weight, for instance

- when it was brought to school that morning, OR
- at the start and at the end of the school day (to look at daily differences) OR
- measured each day for one week.

3. Consider the reliability of the data [C], and what might influence its reliability. Get the students to workshop how confident they are that the data they have collected is truly indicative of the real situation. They should consider issues such as:

- Using the same scales in the same way each time to measure student and bag weight
- Is 'today' an average day in terms of the amount of weight carried (i.e. do you need to measure school bag weight across a week to get an accurate perception of loads carried?
- Did all the students tell the truth in the questionnaire?
- Do students' perceptions of spinal pain change from day-to-day depending on how they feel?

4. Collate the survey data [SG]. Students could collate results by hand in tables, or they could use MSExcel spreadsheets for data entry and collation. Refer to the electronic file ***Sample Survey Data.xls*** in **Mathematics Resources for Teachers** for an example of a spreadsheet that could be used to store results from the iCAHE survey, and student body weight and school bag weight. A hard copy of this spreadsheet is also included in the **Mathematics Resources for Teachers**.

You will notice that the electronic version of the spreadsheet contains five days of data collection (tagged at the bottom of each sheet). The spreadsheet called **Monday Raw** data contains hypothetical data from 14 students from all elements of the iCAHE questionnaire. It also contains data on the weight of the school bag, and weight of student. The following four tagged spreadsheets (Tuesday Repeat Data, Wednesday Repeat Data, Thursday Repeat Data, Friday Repeat Data) contain repeated questionnaire elements from the same survey (Questions 7-13) which could be collected every day, as well as daily measures of the weight of students' school bag load. Student body weight could be re-measured every day too, if you want. We have included the hard copy data entry format for Friday Repeat Data in the **Mathematics Resources for Teachers** for reference.

Objective 2: ***To allow students to reflect on the impact that load carriage habits may have on spinal health***

Students should consider the following questions:

- Is the weight of my bag a risk to my spinal health?
- As a class, are we carrying too much weight?
- Is spinal pain likely to be related to the way that bags are carried, or to other activities, such as the length of time spent sitting?
- Was the information that we collected valid and reliable?

Tasks

1. Review the PowerPoint presentation [C] in **Adolescent posture, spinal pain and backpacks.ppt** and in the policy document (**Spinal health for school students**) and get the class to discuss the importance of considering the weight of bags carried and the way in which they are carried.

2. Calculate the average weight of the school bags in the class [SG] following the example in the sheet called '*Average bag weight'* in **Maths Worked Examples.xls**.

3. Compare the weight of individual school bags with the class average [SG]. Replicate the graph in the sheet called '*Average bag weight'* which shows across each day of the week, the average school bag weight, and the weight range (calculated as plus and minus the Standard Deviation). The class variability could also be calculated as the maximum and minimum.

4. Consider whether school bag weight should be reduced [SG]. Research by the Centre for Allied Health Evidence, University of South Australia, suggests that school bags should weigh no more than 8% of individual student's body weight. The sheet called *%BW* in **Maths Worked Examples.xls** gives an example of how to calculate the actual percentage of body weight carried on Monday in school bags by each student in the class. This was calculated as (school bag weight / body weight)*100.

The sheet called *8%BW* in **Maths Worked Examples.xls** shows the recommended bag weight for the students in the class using the recommended bag weights. This was calculated as Body Weight*8/100. The sheet called *Weight Difference* shows the amount that each student in the class would need to take out of their school bags so that they could meet the 8% weight limit. This was calculated as actual school bag weight – 8% body weight (in kilograms).

Students should calculate the percentage of their body weight they carried on the day of testing, and how much greater than 8% of body weight this was.

5. Consider the relationship between neck pain today (or another measure of spinal pain) and school bag weight [SG]. Students should consider the example on worksheet *Neck Pain & Bag Weight* in **Maths Worked Examples.xls**. The graph on this sheet shows the relationship between neck pain today and bag weight in the sample data. Students should replicate this graph using their own data. We also separated the data into two groups of students – with and without neck pain, and calculated the average weight carried.

Objective 3: ***To guide students to make load carriage recommendations which could be readily implemented by themselves, or discussed further with school management***

Students should consider the following questions:

- What were the factors that were identified as being related to spinal pain, from our class survey (i.e. sitting too long, carrying too much weight?)
- What changes could we make to these factors?
- How could the effectiveness of these changes be measured?
- What did other classes find?
- Could Year 8 develop a policy on factors which are related to spinal pain?

Tasks

1. Construct a presentation for other Year 8 students [SG] using MS:Powerpoint, or Role playing/poster presentations outlining their findings for the questions from the previous objective

2. Develop recommendations [C] for the school community in order to address these findings

3. Consider barriers to uptake [C] of these recommendations. Get the class to consider why they may have difficulty making these recommendations work in the real world.

4. Make a presentation [SG] to another class, OR to the Spinal Health Committee OR to a School Assembly, presenting recommendations for better spinal health, drawn from their survey data.

.

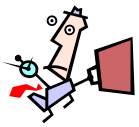
Mathematics Resources for Teachers

Survey Instrument

designed by International Centre for Allied Health Evidence (iCAHE), UniSA for use in research activities[17-27]

Questions marked ** can be used for repeat questioning through a week

**NAME		
GENDER (*Tick*)	Male	Female
**TODAY'S DATE		
DATE OF BIRTH		



1. What sort of bag did you bring your schoolbooks in today? *Please tick*
   (A backpack has two shoulder straps, a satchel has one long shoulder strap and other is any other type of school bag)

   ○1 Back pack
   ○2 Satchel
   ○3 Other……..

2. 2. If you have the following, how often do you use them? *Please tick*
   (PLEASE TICK ONE FOR EACH LINE)

	NEVER *n*	SOMETIMES *s*	ALWAYS *a*	DON'T HAVE IT *d*
a) Waist belt	○	○	○	○
b) Chest strap	○	○	○	○
c) Side compression straps	○	○	○	○
d1) Other (please name) d2…….	○	○	○	○
e) How often do you adjust your shoulder straps	○	○	○	○

3. How long in total do you normally spend carrying your bag? *Please tick*
(PLEASE TICK ONE ONLY)

a) **BEFORE SCHOOL**			
○1	Less than 5 minutes	○2	5- 10 minutes
○3	11- 20 minutes	○4	21- 30 minutes
○5	Over 30 minutes	○6	Do not carry it

b) **DURING SCHOOL**			
○1	Less than 5 minutes	○2	5- 10 minutes
○3	11- 20 minutes	○4	21- 30 minutes
○5	Over 30 minutes	○6	Do not carry it

c) **AFTER SCHOOL**			
○1	Less than 5 minutes	○2	5- 10 minutes
○3	11- 20 minutes	○4	21- 30 minutes
○5	Over 30 minutes	○6	Do not carry it

4. How do you **<u>normally</u>** carry your bag to and from school? *Please Tick*
(PLEASE TICK ONE ONLY)

○	*bs* Both shoulders	○	*rh* Right hand
○	*rs* Right shoulder	○	*lh* Left hand
○	*ls* Left shoulder	○	*bh* Both hands in front of you
○	*o* Other *(name)* ……		

5.

a) Do you have a locker? *Please Tick*

○1 Yes ○2 No

If no, please go to question 8

b) If yes, how often do you use it? *Please Tick*
(PLEASE TICK AS MANY AS YOU LIKE)

○1 Start/finish of the day ○2 During recess and lunch

○3 Between classes ○4 Not often

○5 Never

6. How many **hours a day** do you spend in each of these chairs?
(For example: school chair -3.5)


a) Couch _____


b) Arm Chair _____


c) School Chair _____


d) Dining/kitchen chair _____


e) Office/Desk chair _____

f) Bean Bag _____


g) Stool _____

h) Floor _____


i) Other (*please specify type of chair and time spent in chair*)
_____

7. **In a usual week, how often do you experience pain in spine (neck, low back or upper back)? *Please Tick*

○1 Every day ○2 5-6 days per week

○3 3-4 days per week ○4 1-2 days per week

○5 Never

1. **Last week, did you experience neck pain? *Please Tick*

○1 Yes ○2 No

2. **Last week, did you experience low back pain? *Please tick*

○1 Yes ○2 No

3. **Last week, did you experience upper back pain? *Please tick*

○1 Yes ○2 No

4. **Today, are you experiencing neck pain? *Please tick*

   ○*1* Yes ○*2* No

5. **Today, are you experiencing low back pain? *Please tick*

   ○*1* Yes ○*2* No

6. **Today, are you experiencing upper back pain? *Please tick*

   ○*1* Yes ○*2* No

Q14. **Weight of school backpack_____

University of South Australia

Using MS Excel for spinal health curriculum

Descriptive measures, and calculating reliability of measurements.....

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University of South Australia

Data = measurements

- Data comes in several forms ..... what is your data is in?
- Quantitative (number-based)
  - Scaled equal interval data
  - Categorical data
- Qualitative (word-based)
  - words, concepts, theme measurements

The data collected for your backpack survey is almost all quantitative

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Scaled equal interval data

- **Objective measurements**
  - undertaken by one person of another
  - usually require a calibrated measurement instrument and / or a standard definition of the measure
    - goniometer, stop watch, tapemeasure, scales, callpers etc

These measurements are always scaled in equal and/or logical intervals

Each interval is the same as any other interval (this is how you can work it out if you are stuck!!!)

It comes in two types

- continuous (can be parts of a whole number)
- discrete (can only be whole numbers)

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Examples

- Continuous measurement (parts of a whole)
  - Height (cms, parts of metre)
  - Age (years, months, parts of years)
  - Time (seconds, parts of minutes, etc)
- Discrete (whole numbers only)
  - Number of successful attempts at a test
  - Number of times you have done something (eg in the last month)

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Categorical measurements

- **Where there is no assurance of equal intervals of measurement**
  - These measures are commonly undertaken by an individual of himself / herself
  - They sometimes involve one person measuring another
  - They come in two types
    - ordinal (ordered / ranked intuitively)
    - nominal (no ordering, designation by name only)

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Examples

- Ordinal (categories with ordered scores)
  - Categories of amount of time spent carrying the school bag
- Nominal
  - Gender

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Descriptive statistics

- Equal Interval data
  - Averages (means)
  - Standard Deviations
- Categorical data
  - percentages

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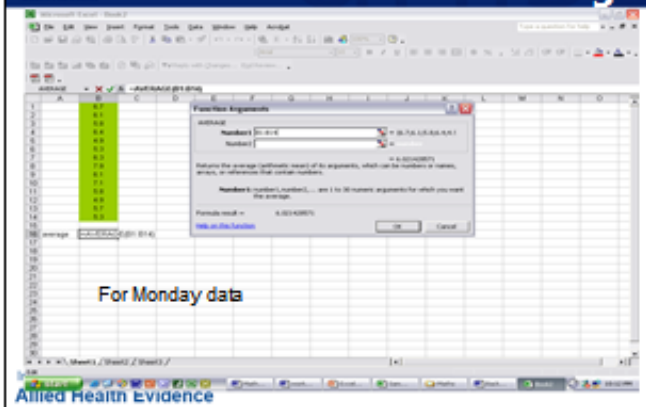
Calculating average back weight



For Monday data

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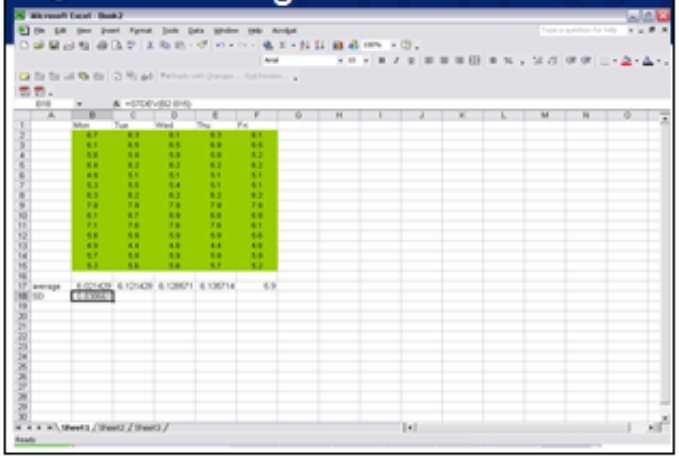
Calculating Standard Deviations



Reliability = agreement between measurements taken on different occasions

Reliability

Tests the hypothesis that:

- one set of measurements will be the same as any other set of measurements taken from:
  - the same subjects
  - by the same or different measurers
  - under the same circumstances (I.e. time of day)
  - using the same (valid) measuring instrument

Using any statistical test:

You are seeking to demonstrate that there is no difference between tests

- seeking p values > 0.05

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Types of research questions

- Reliability with yourself
  - Do you get the same measurements on repeated occasions of testing?
- Reliability with others
  - Can your whole group get the same results on repeated occasions of testing?

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Elements of error

- Tool (instrument, device, equipment)
  - inherent error in design, calibration, protocol interpretation
  - variable performance (heat, constant use effects, vibration etc)
- Measurer
  - inherent correlated errors in taking measurements (always reads high/ low)
  - variable ability to:
    - apply the protocol
    - operate the device

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Subject variability
(not error!!)

- Subjects may perform differently on repeated occasions of testing
  - natural variability in performance
  - OR may reflect:
    - a learning effect
    - a fatigue effect
    - an expectation effect
    - an anticipation effect

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Equal interval measures

Research questions and statistics

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Item being measured	measurer	test 1	test 2
bag 1	1	12	12.5
bag 1	2	11.8	12.1
bag 1	3	11.8	11.9
bag 1	4	12.2	12.5
bag 1	5	11.8	11.9
bag 1	6	12	12
bag 1	7	11.7	11.9
bag 1	8	12.4	12.9
bag 1	9	11.4	11.8
bag 1	10	11.5	11.5

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Statistics for testing individual agreement of equal interval data

- Mean and standard deviation
  - For each individual
  - For the entire group
- % difference for the individual
  - Seeking < 5% difference for each person
  - For each individual in the group
    - calculate the mean and standard deviation
    - calculate the percentage difference between the repeated measures
      - ((Test 1 – Test 2)/Test 1) * 100

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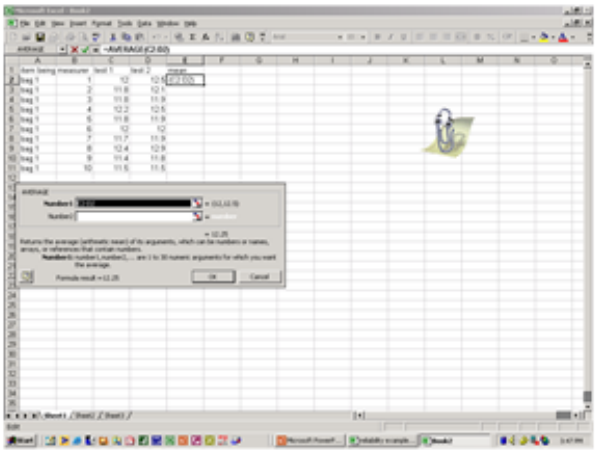

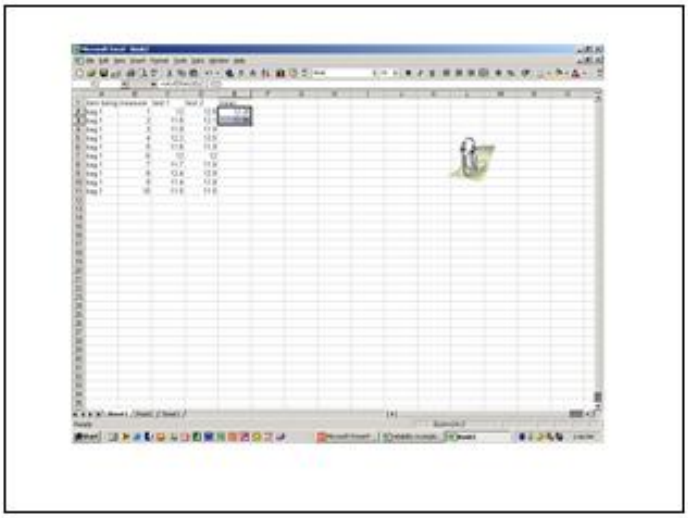

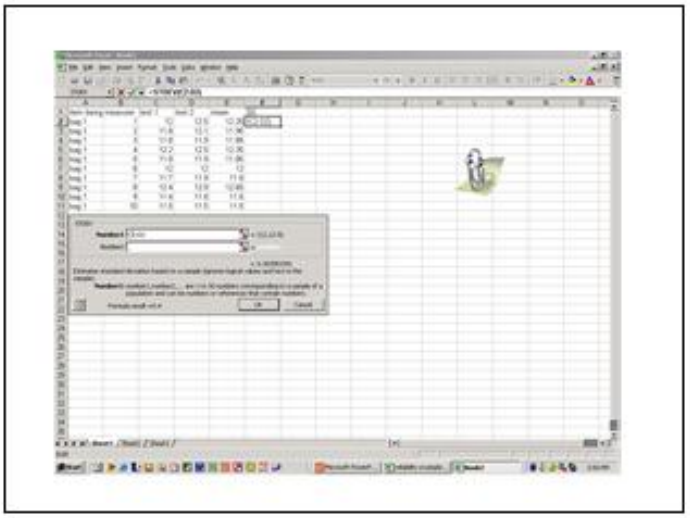

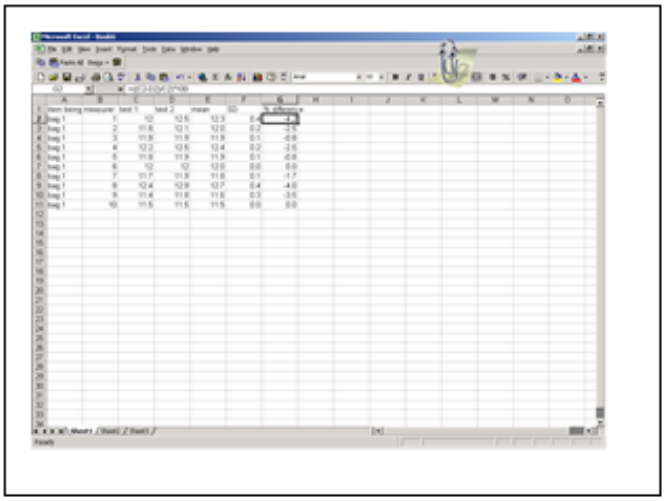

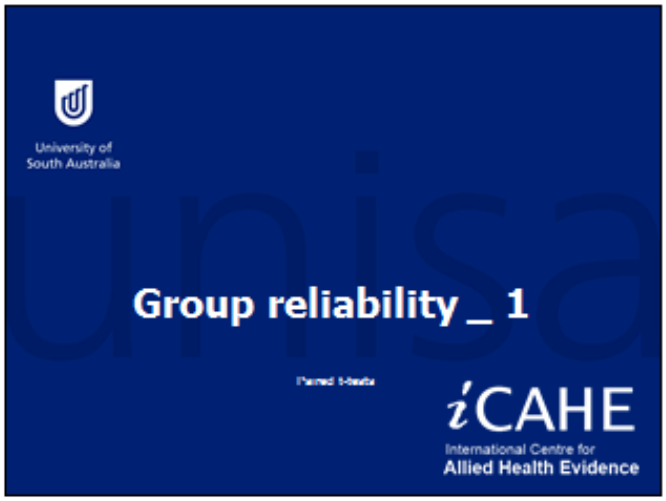
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Group reliability _ 1
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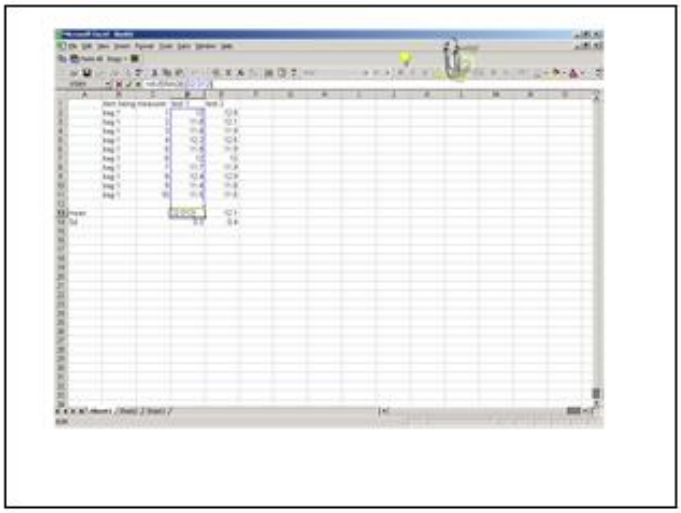
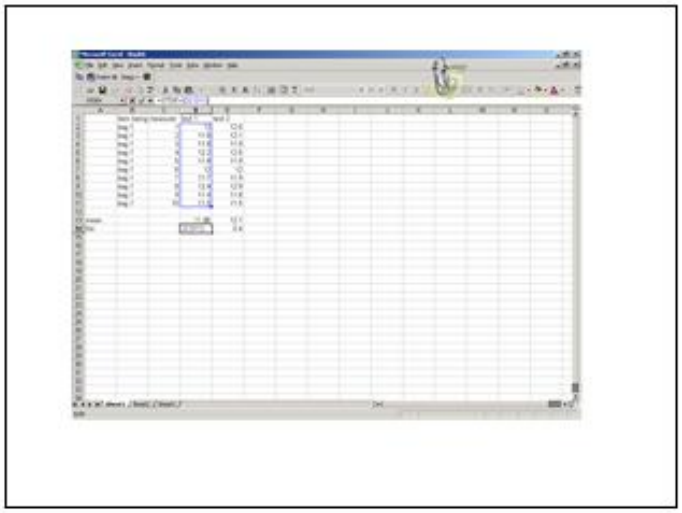
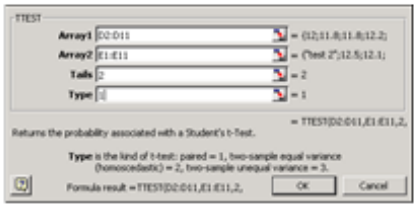




Testing group reliability_1



- Paired t-tests for two sets of data
  - Seeking p>0.05

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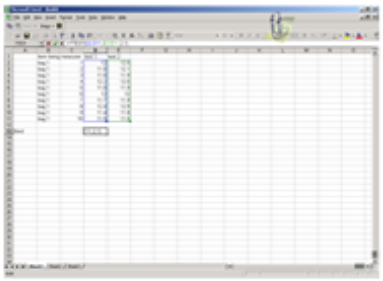
Testing group reliability_1



p=0.003

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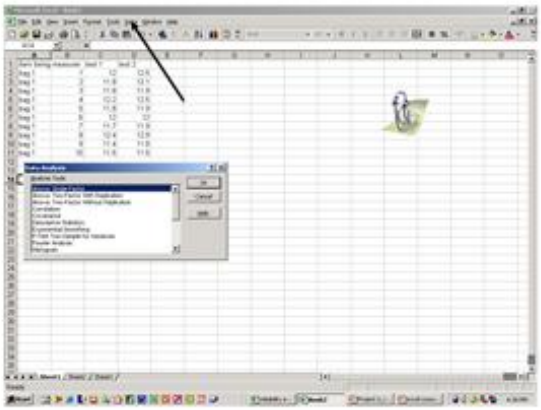

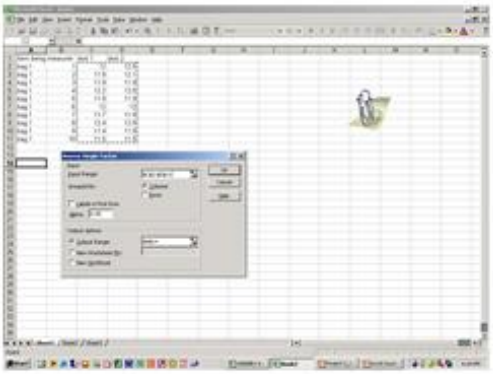

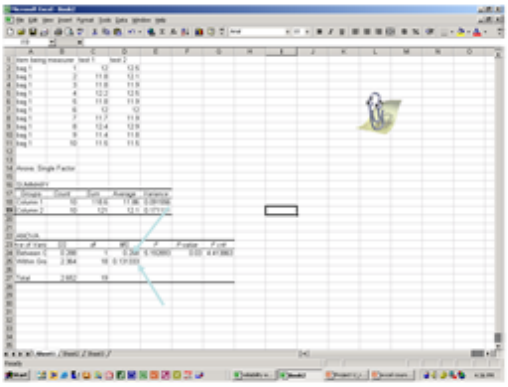

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Testing group reliability_2

Scatter plots and Pearson r

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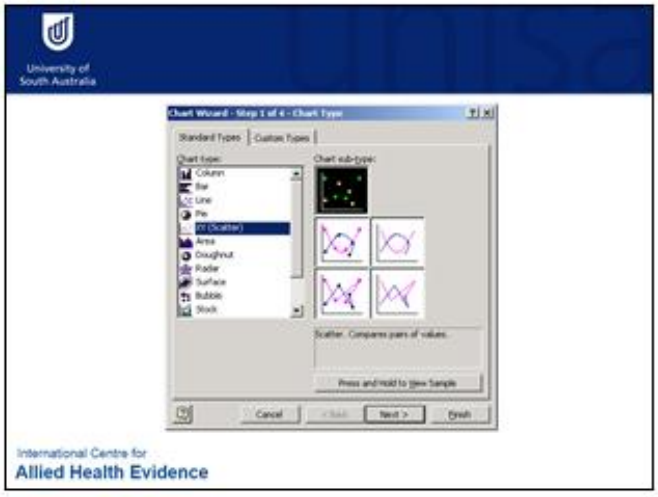
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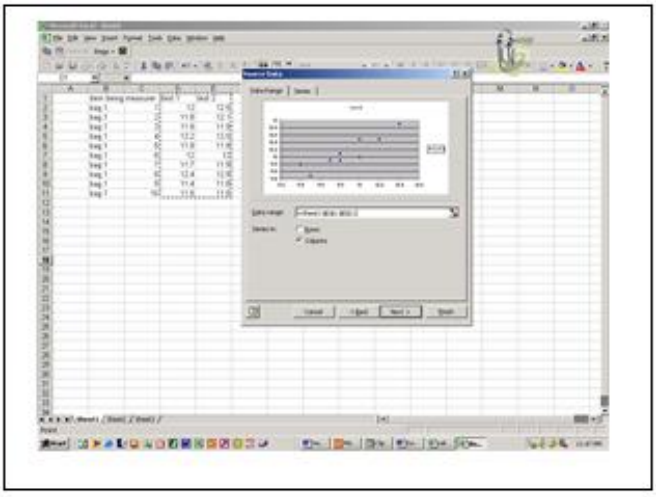

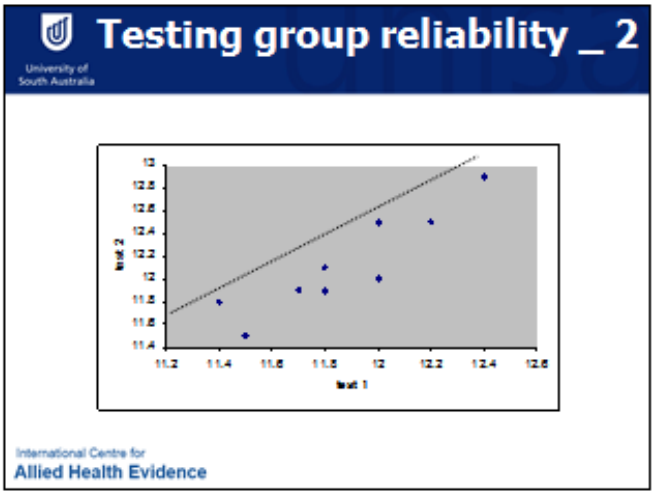
Testing group reliability _ 2
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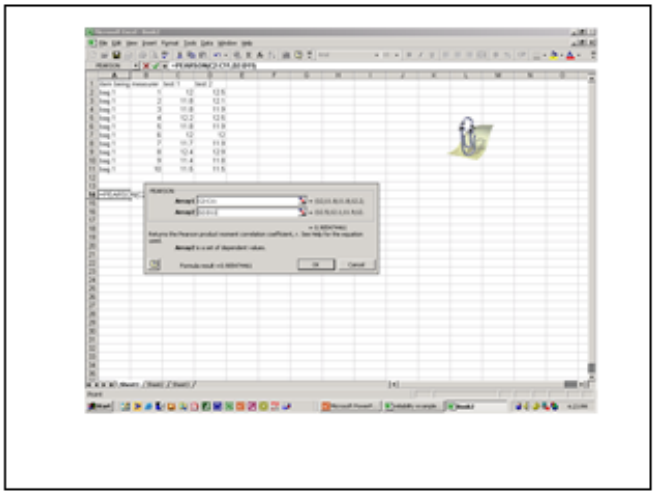

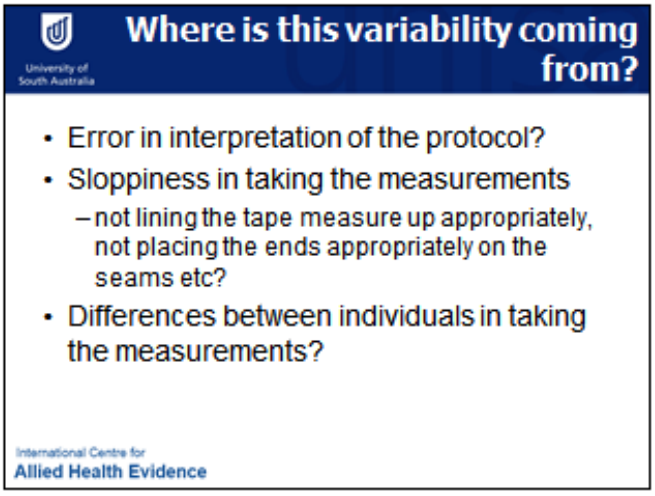
Where is this variability coming from?
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• Error in interpretation of the protocol?
• Sloppiness in taking the measurements
– not lining the tape measure up appropriately, not placing the ends appropriately on the seams etc?
• Differences between individuals in taking the measurements?
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Categorical measures
iCAHE
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Agreement between categories

- % agreement
  - Quick way of undertaking reliability testing (0% - 100%)
- Movement between categories
  - Particularly useful if variability differs in subgroups of patients

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Item being measured	measurer	test 1	test 2
Brace test 1	1	Y	Y
Brace test 1	2	Y	N
Brace test 1	3	N	N
Brace test 1	4	Y	Y
Brace test 1	5	N	Y
Brace test 1	6	N	N
Brace test 1	7	Y	N
Brace test 1	8	Y	Y
Brace test 1	9	N	Y
Brace test 1	10	N	N

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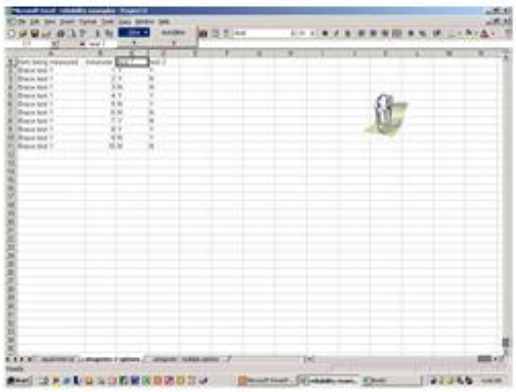

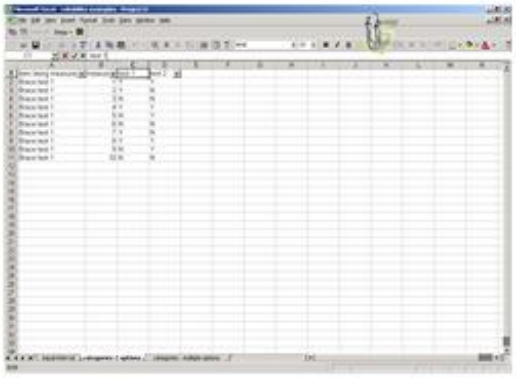

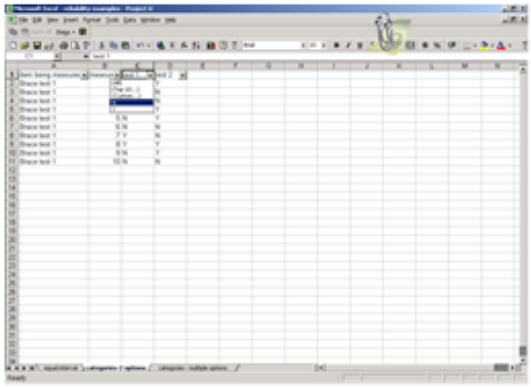

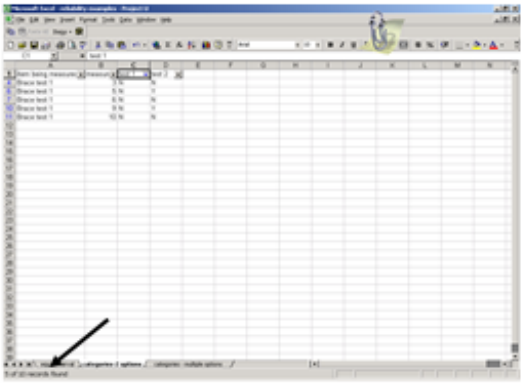

When there are only 2 options

	Yes (Test 1)	No (Test 1)
Yes (Test 2)		
No (Test 2)		

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When there are only 2 options

	Yes (Test 1)	No (Test 1)
Yes (Test 2)	3	2
No (Test 2)	2	3

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When there are three ore more categories (a,b,c etc)

	tester	Test 1	Test 2
Bag 1	1	a	a
Bag 1	2	a	b
Bag 1	3	b	b
Bag 1	4	a	b
Bag 1	5	b	c
Bag 1	6	b	b
Bag 1	7	a	c
Bag 1	8	b	b
Bag 1	9	b	b
Bag 1	10	a	a

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Agreement between categories

- Chi^2 is ratio of observed proportions compared with expected proportions
  - interpretation depends on the hypothesis
    - H_{null} = there is no difference in proportions on test-retest (i.e. reliability testing)
    - For reliability testing you are seeking $p>0.05$ associated with the chi square statistic to show no differences between the two tests

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Agreement between categories

Test 2 \ Test 1	a	b	c	% Row
a	2	0	0	% Column
b	2	4	0	% Total
c	1	1	0	
	5	5	T = total	

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Frequency distribution of the three categories on the three tests

	a	b	c
Test 1	5	5	0
Test 2	2	6	2

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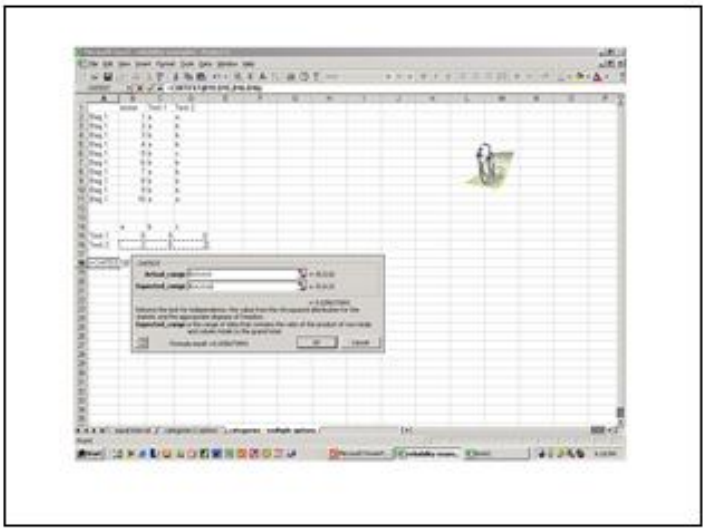
Resource manual for curriculum for first year high school students:
Developing good lifelong spinal health behaviors



To be used at teachers' discretion and in conjunction with the Additional Material

5. ENGLISH

This unit of work addresses two of the three scope key ideas in the 'Texts and contexts' strand of the English learning area, as given in the SACSA framework, which are:

- Students respond to increasingly complex ideas and information and examine diversity of opinion when listening to a range of texts. They critically and creatively produce a range of spoken texts about topics and issues for a wide range of audiences. **T. C.** KC2. KC6
- Students choose and compose a range of written texts which explore different perspectives about local and some global issues. They apply an understanding of context, purpose and audience to their own writing. **In. T. C.** KC2. KC3

This unit of work can be evaluated using the Standard 4 outcomes provided in the SACSA framework.

STANDARD 4
Students use a range of reading/viewing strategies to research independently and in teams, record specific information and critically interpret increasingly complex texts. *KC1 * KC2 * KC4*
4.4 Students compose a range of texts that include detailed information and explore different perspectives about a range of issues and adjusts texts for particular audiences, purposes and contexts. *KC 2*
4.11 Students control, adjust and compare a variety of strategies for locating and recording information and for reading, viewing and critically interpreting written and visual texts for specific purposes. KC1 * KC2

5.1 Objectives

1. To heighten student awareness of load carriage issues from a personal, national and international perspective.
2. To encourage students to explain, using a variety of methods, how load carriage may impact on spinal health.
3. To encourage students to explain how risks to spinal health could be minimised.

5.2 Key ideas overview

Strand: Texts and Contexts

The texts and contexts strand outlines the understandings and skills learners need to enable them to engage with, produce and respond to a range of texts across the levels of schooling .The term "text" is broadly used to mean any communication involving language, and may be spoken, written, visual, digital or in a combination of modes.

The situational context in which a text and its language is constructed or comprehended varies according to the purpose, audience and subject; and whether it is spoken, written, visual or multimodal. The emphasis of this unit (through the reading of the accompanying articles) is to heighten student awareness of load carrying with specific reference to backpacks, and how excessive loads are linked to poor posture.

5.3 Suggested units of work/tasks to address

Objective 1: To heighten student awareness of load carriage issues from a personal, national and international perspective

Students should be able to answer the following questions;

- Why are researchers worried about school students carrying backpacks?
- What other issues may impact on the spinal health of school students?

Tasks

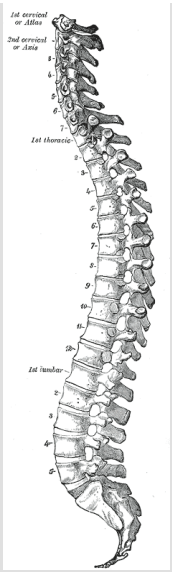
1. **Read five newspaper articles [I]** (like those referenced in the English Resources for Teachers)
2. **Write a brief summary [I]** of the main points raised in each article (consider spinal pain, loads, locker use, posture etc)
3. **Read the DECS Policy Document [SG]** (Provided in the Generic Resources Section of this curriculum 'Spinal health for school students') and consider how the information relates to what students do on a day-to-day basis. For your class to comply with the recommendations in the Policy Document, would you have to make many changes to your day-to-day spinal health behaviours?
4. **Identify the major issues [C]** that face schools and young people today regarding protecting their spinal health. They could be the topic for a class discussion, or one or more issues could be presented in the form of a role-play. These issues may include:
   - The increasing problem of back pain in older children and teenagers
   - The fact that backpacks can be risk factors for the development of low back pain if they are too heavy or worn incorrectly (e.g. over one shoulder)
   - Other potential causes of low back pain are also issues, including; long periods spent sitting, school desks and lockers being too high or too low, unsuitable home furniture (e.g. desks, couches, bed mattresses.
5. **Make up a list [I]** of ten new words/ phrases that have been mentioned in the articles, and find out the meanings of these words.

Objective 2: *To encourage students to consider how risks to spinal health could be minimised*[1]

Students should consider how risks to spinal health could be minimised?

Tasks

1. **Consider the information [C]**. that students have learnt in this unit, and based on this and their own views on the issues, outline practical solutions that may help to overcome the problem. Students should consider how these suggestions could be implemented in their school/ home.
2. **Write a document, or prepare a presentation [I]**. explaining what they have learnt. For example, students could write a letter to a friend OR to the local newspaper (i.e. to be read by the general public) OR an article for the school newsletter (i.e. to be read by parents, teachers and students), to explain the issues surrounding the spinal health of young Australians, and giving some advice/ making recommendations for young people. Alternatively, students could prepare presentations based on the same information, aimed at different audiences. For example, students could pretend to be talking to; a community meeting, another Year 8 class, the Year 12 School Committee, the school speech night etc.
3. **Write a humorous short story [I]**. for younger children titled "The Boy/Girl whose back pack was too big" or a short story about teenagers who carried a weird assortment of things in their school bags, not leaving much room for school books!!.



[1] Note that in other spinal health curriculum units, students will be asked to make recommendations regarding what bags should be used, how bags should be worn, and how bag weights could be minimised. Whilst these factors will be important to note for this unit, student discussions should focus on other issues.

HEAVY BACKPACKS A SCHOOL HEALTH HAZARD, SAYS SPECIALIST

STUDY: Dr Negrini yesterday ... "a risk factor for low-back pain."

By Medical Writer
BARRY HAILSTONE

SCHOOL backpacks were a health hazard for children, a world authority on back injury rehabilitation told a conference in Adelaide yesterday.

Italian specialist Stefano Negrini told an international meeting of spinal research specialists that parents, teachers and schools should cooperate to reduce the weight of backpacks.

He said back pain was increasingly a problem in older children and teenagers, in whom prevention could be even more important than in adults.

He said some children and teenagers carried loads which were twice the load-to-body-weight ratio set down by international labor laws for manual workers.

Dr Negrini, of the Don Gnocchi Foundation Care and Research Institute in Milan, was an opening speaker at this week's International Society for the Study of Lumbar Spine meeting at the Adelaide Convention Centre.

"Repetitive loading of the spine constitutes a risk factor for low-back pain and the daily loading condition most typical in children are backpacks crammed with heavy books," he said. The long-term effects were not known but fatigue, discomfort and pain were reported.

Dr Negrini reported on his study in Milan of more than 1000 children where the average load carried every day by pupils aged 11 to 12 was 9.3kg, with a maximum of 11.5kg.

"The ratio of load to body weight on average is 22 per cent but more than 30 per cent of body weight is carried at least once during the week by 35 per cent of pupils," he said. These ratios were higher than international labor laws for adults – about 20 per cent.

From observation he had no reason to believe that schoolchildren in Australia and other countries were not carrying the same loads.

Although children in the same classes were issued with the same books, there was great variation in individual backpack loads, suggesting that parents, teachers and education bodies should take action to reduce "the burden of education" on young spinal columns.

The president of the SA Primary Principals Association, Leonie Trimper, said Dr Negrini's study could not be ignored. The problem of heavy backpacks was increasing, particularly for older students.

A learning curve no one wants

By Education Reporter
BELINDA HEGGEN

ONE in every four school students suffer from lower back or neck pain – with the weight of carrying heavy school bags a leading cause.

Research by the University of South Australia's Centre for Allied Health Research found excessive loads are also linked to poor posture.

The results of the three-year study – conducted on more than 1300 students from 12 public schools – has prompted one South Australian school to take preventive action.

Henley High School has formed a working committee of teachers and health professionals aimed at reducing the risk of injury by re-educating students on the best way to carry bags.

Principal Lyn Wright said yesterday students were aware of the dangers of using school bags incorrectly, but proper practices were needed as part of the curriculum. "We have found that Years 9, 10 and 11 students are most at risk because they tend to carry more books and hence we will be identifying strategies particular to each level," Ms Wright said.

"One of the areas we will be investigating is the way in which students utilise their lockers ... so they can lighten their school bag loads."

Director of the centre Dr Karen Grimmer said backpacks should weigh no more than 10 per cent of students' body weight. "While young spines are maturing they are highly susceptible to damage," she said. "If a bag's too heavy, it puts strain on the shoulder, neck because you lean forward to compensate."

The researchers used their findings to work with the Australian Physiotherapy Association and school supplier Spartan to develop an ergonomically-designed backpack. Called the PhysioPak, its design addresses the heavy "sag" problem often incurred by students by preventing the bag from being overfilled.

Its moulded, padded back also reduces strain on the spine, reducing the body's natural response to lean forward.

Henley High School Year 10 student Jenny Bage, 15, said the PhysioPak felt "weird but good" because she was unused to its moulded shape against her back. Fellow Year 11 student Josh Peak, 15, said he often felt shoulder pain on Mondays when he had to carry textbooks for each of his six subjects.

Education Minister Malcolm Buckby said research into students' spinal health was important and backed Henley High School's move to develop its own safety strategies.

THE OLD

Year 11 Henley High student Josh Peak blames himself for his shoulder pain because he carries his bag from class to class.

THE NEW

Year 10 Henley High student Jenny Bage says the Physiopack feels "weird but good" because she is not used to its moulded shape.

Resource manual for curriculum for first year high school students:
Developing good lifelong spinal health behaviors

To be used at teachers' discretion and in conjunction with the Additional Material

Print Post Approved PP565001/00412 Issue 1 Term 2, 2000 50 cents

Aussie kids carrying a huge load

Three Queenslanders carrying a heavy load to school

Do you or your friends carry 'everything but the kitchen sink' in your school backpacks? All that weight may not be very good for your back.

Backpacks are by far the most popular way of carrying your school things. However, a study conducted by a team led by Dr Karen Grimmer, Director of the Centre for Allied Health Research at the University of South Australia, found that the average load students carry in their backpack is 5.3 kilograms, almost 10% of their total body weight! If that's the *average* weight, this could mean that close to half of all Australian students are carrying a lot more than 5.3 kilograms!

If you check out all the stuff that's in your backpack you'll find that about 60% of its contents will probably be educational material - text books, exercise books, folders, writing pads, writing and drawing gear (pens, pencils, Textas, rulers etc.), calculators and computer disks.

Then you add your lunch, a drink bottle, sports clothes and equipment, maybe a musical instrument, things you had to bring from home for a special project you're working on, things you brought to show your friends, and the things you've forgotten you had in there, and it all adds up to quite a heavy load!

According to Dr Grimmer, the backpack is still the best way of carrying this load around because it distributes the weight evenly, but only if it's worn correctly and you think carefully about what you put in it. Otherwise a backpack could be bad for your health, causing lower back and neck pain, and posture problems.

You should carry your backpack over both shoulders (it really doesn't look uncool). Why? So you don't develop a lopsided posture, or back pain, from one shoulder being weighed down more than the other. The straps should be tightened and adjusted regularly so that they are worn at the proper length.

You also need regularly (more than once a term!) sort through the stuff that's in your backpack and take out what you don't really need. This might even have unexpected benefits. Who knows what you might find in the dark, mysterious, depths of your very own backpack? Overdue library books, notes you forgot to give to your parents, mouldy sandwiches, and maybe even some forgotten lunch money?

Remember:
If you don't have to carry it, don't carry it!
If you do have to carry it, carry it correctly!

Teen years a pain in the back

OH, MY ACHING BACK: Bag-toting Adelaide High students Ellena King, 15, Avyi Patitsas, 16, and Rose Turner, 17. Picture: BRENTON EDWARDS

By Health Reporter
KELLY STONE

UP to 44 per cent of teenage girls are suffering consistent back pain, SA research has found.

A "diffuse aching-type pain" is reported by 25 per cent of girls in Year 8, increasing to 44.3 per cent by the time girls reach Year 12, say University of SA researchers Karen Grimmer and Steve Milanese.

Dr Grimmer and Mr Milanese presented their findings at the Australian Physiotherapy Association's national conference in Melbourne at the weekend.

The study - the first to investigate adolescent spinal health in Australia - found back pain also was prevalent among teenage boys, with 28 per cent of Year 11 boys reporting pain.

Dr Grimmer, director of the university's Centre For Allied Health Research, said the main causes of teenage back pain were heavy school backpacks and long periods spent sitting for study.

Other potential causes included school desks and lockers being too high or too low, and unsuitable home furniture such as desks, couches and bed mattresses.

"High school students literally carry everything around in their bags from early morning to the end of the day," Dr Grimmer said. "For the girls in particular, who are entering that huge change in environment (from primary school) and are busily growing, it is spinally confronting, whereas boys have another year before they get into that major growth spurt."

She said pain for both girls and boys was reported over a "diffuse" rather than localised area of the back.

She said research started with 1300 high school students in 1998 and had extended to a longitudinal study at four high schools and all Magill Primary students.

It is hoped the research will encourage:

TEENAGERS to be more aware of posture and the importance of physical activity.

SCHOOLS to consider spinal health when positioning desks and lockers.

PARENTS to be aware of furniture at home and to look at causes of "growing pains".

PHYSIOTHERAPISTS to think about how they can educate, rather than treat, teenagers with back pain.

Adelaide High School Year 11 students Ellena King, Avyi Patitsas and Rose Turner said they had all experienced "on and off" back pain, which they thought came from carrying heavy school bags.

THE AGE
TUESDAY FEBRUARY 6, 2001
BREAKING NEWS theage.com.au

New pack takes the 'ouch' out of lugging books

By **BRETT FOLEY**

There was a time when children would go to school with little more than a pencil, an exercise book, some sandwiches and an apple in a knapsack slung over the shoulder. How times have changed.

Parents have long been concerned that their children carry too much weight in their backpacks, which they fear could cause long-term posture damage.

Those concerns have led to the development of an innovative backpack, the brainchild of Dr Karen Grimmer and Steve Milanese from the University of South Australia.

The pair worked with a bag company to develop the design. With funding from the Australian Physiotherapy Association the backpack was launched yesterday.

The researchers conducted a study of 1300 students which found that, with text books, laptop computers, musical instruments and sporting equipment, some students were carrying up to 22 kilograms to and from school.

Dr Grimmer said: "When children are maturing their spines are highly susceptible to damage and we have seen a concerning prevalence of neck and back pain among some older students who had been over-carrying for many years."

He said some students were taking pain relievers.

The new bag has wide straps that keep the contents close to the spine, has compartments so items don't move around, and is designed to ensure it can't be overpacked.

The pack also comes in different sizes.

Dr Grimmer cautioned that while the backpack may help with the child's long-term posture problems, it was not a complete solution to avoiding back pain. Poor posture was caused by many factors, all of which should be taken into account by parents, she said.

How to lighten the load

- Pack the heaviest items closest to your spine.
- Use both shoulder straps.
- Use the waist strap when you are walking/cycling.
- Take a break over long distances.
- Plan ahead, only carry books for that night.

Source: The Centre for Allied Health Research

Comfy: Georgina Clarke and Hamish Norris try the new backpacks. Picture: RAY KENNEDY

Mr Milanese said the current school generation was a "transitional group" caught between the era of the textbook and the era of computers and online education.

"They are carrying lap-tops but education has not progressed to the stage where they can throw away the text books," he said.

Dr Grimmer and Mr Milanese are entering the third year of a study charting the progress of year eight students who have been testing the backpack since 1999. They hope the results of the study will reinforce their previous work and lead to a change of policy by educational institutions to deal with the posture problem.

Dr Grimmer said their next step was to talk to schools.

6. SCIENCE

This unit of work addresses the two scope key ideas in the 'Energy systems' strand of the Science learning area, as given in the SACSA framework, which are;

- Students collect data about, and critique, their own patterns of energy use in terms of its environmental impact. **F. Id. C.** KC1. KC5. In particular, this unit of work focuses on;
    - Critically reflecting on the ways in which such ideas as forces, work and energy can be used to understand every day events and processes. **T. C.** KC1
    - Applying concepts about work output to a variety of physical activities. **Id. T. C.** KC5
- Students use the concepts of force, energy and transfer of energy to investigate and explain phenomena and changing patterns of events in the natural world. **In. T.** KC1. KC2.

This unit of work can be evaluated using the Standard 4 outcomes provided in the SACSA framework.

STANDARD 4
Students use the concepts of force, energy and transfer of energy to investigate and explain phenomena and changing patterns of events in the natural world.
KC1 * KC2 * KC3 * KC4 * KC6

6.1 Objectives

1. To teach students about the concepts of equilibrium and stability, as they relate to inanimate objects and to the human body
2. To teach students about the effect which load carriage has on posture, equilibrium and energy expenditure of the body
3. To teach students about:
    - the structure and function of the vertebral column
    - posture, how it relates to the position of the spine, and why it is important to maintain good posture
    - potential risks to the spine

6.2 Key ideas overview

Strand: Energy systems

In this strand students use the concept of force, energy and transfer of energy to investigate and explain human movement and the restrictions placed upon it from internal and external elements. They will examine the associated problems of forces and how they can impact on posture and therefore development. In order to understand the effects of external forces on posture students need to have a working knowledge of the structure and function of the vertebral column.

6.3 Suggested units of work/ tasks

Objective 1: ***To teach students about the concepts of equilibrium and stability, as they relate to inanimate objects and to the human body.***

Students need to be able to answer the following questions:

- Define Centre of Mass and Line of Gravity, related to an object.
- What do we mean by equilibrium?
- What do we mean by stability?
- How could you affect the stability of an object?
- Why is Equilibrium and stability important for the human body?

Tasks

1. **Consider centre of gravity [SG]**. Find some everyday objects and try to see if you can locate their centre of gravity. Try a ruler, a brick, a pencil case, a backpack and others of your choice.
2. **Experiment [SG]** by shifting their base of support in relation to the line of gravity. What happens when you shift the line of gravity outside the base of support?

   Take a brick or similar object, stand it on its end, now tilt it away from the midline – what eventually happens? What could you now say about its centre of gravity?
3. **Consider stability [C]**. . Which of the following two positions in gymnastics are the most stable and why? A headstand or a handstand. (**Photos of posture and balance examples and ideas are available electronically in Science Resources for Teachers. Hard copies are also provided in this document in Science Resources for Teachers section).**
4. **Examine the diagrams in Science Resources for Teachers [SG]**. showing postural deviations associated with common activities. Can you see the differences? How might you account for the results in light of what you have discovered about centre of gravity and equilibrium?
5. **Design a range of experiments [SG]** that show what actually happens to our posture when subjected to various changes. You might like to consider looking at simple measurements in normal standing positions, exaggerated standing positions, normal sitting positions, your favourite sitting position, standing with your back pack on your side, standing with your back pack over your shoulders but sitting right down in your lumbar region, standing with your back pack elevated and so on. When you have completed your experiments you should be able to come up with a series of diagrams that clearly show the adjustments that your body makes when subjected to poor postural alignment.
6. **Consider [SG]** the long-term consequences for your posture of incorrectly carrying a heavy backpack, or using furniture?

Objective 2: ***To teach students about the effect which load carriage has on posture, equilibrium and energy expenditure of the body***

Students should be able to answer the following questions:

1. What is the association between equilibrium and stability of the human body, and load carriage?
2. How does the way you carry the load affect the equilibrium and stability of the human body?
3. Why do you want to carry loads in a way to minimizes the disruption to equilibrium and stability?

Tasks

1. **Examine the diagrams [I]** showing postural deviations associated with common load carriage scenarios *(refer to* **Adolescent posture, spinal pain and backpacks.ppt,** and the photos in the '**Posture' section in the Science Resources for Teachers Section***).*
2. **Detect differences in posture**, **[SG]** using the photos and the diagrams in the PowerPoint presentation How might they account for the results in light of what they have discovered about centre of gravity and equilibrium?
3. **Consider [SG]** what happens to posture when backpacks are worn in different ways. Students might like to consider looking at simple measurements of the body:
   - Standing with backpack on correctly (i.e. bottom of pack at waist level, over both shoulders, waist belt done up, top of backpack comes to level of shoulders)
   - Standing with back pack over both shoulders but with the pack very full, so that it protrudes away from the body quite a distance.
   - Standing with back pack over one shoulder
   - Carrying a heavy load with backpack on correctly
   - Standing with a satchel carried in one hand by the side of the body
   - Standing with a satchel carried by both hands in front of the body
4. **Describe [SG]** what will happen to the spine and to posture.
5. **Trial [SG]** their ideas by getting one student to wear the packs in the manner described above. Get them to consider the effects in terms of both equilibrium and energy expenditure. How should a load be carried to minimise disturbances to posture?

Objective 3: ***To teach students about the spine and how it works.***

Students should be able to answer the following questions:

- What is the purpose of the spinal column?
- What elements are encompassed in the spinal column?
- Why are there curves in the spinal column?
- What happens when these curves change?
- What potentially happens to the spine when we stand badly? Sit badly? Use a computer set up at the wrong position? Carry a backpack that is too heavy?
- How might spinal pain be related to structures of the vertebral column?

Tasks

1. Consider the vertebral column **[C]**

- Its structure – how is it actually constructed?
- What are the components that make up the vertebral column?
- Its function – what does it actually do?
- The different regions of the spine, and their function.
- Common problems affecting the spine

2. Define posture [C]

- How does posture relate to the body position in day-to-day activities?

3. Observe [SG] other students in the class during their usual school day

- How do they stand, sit, bend, lift their school bags?
- How could they do these things better?

4. Observe [SG] the furniture in your classrooms and how your classmates use this furniture

- Are there some students who do not 'fit' into the furniture?
- Why not?
- What could be done to assist these students?

Science Resources for Teachers

Activities designed to put this information into practice.

- Look at the two diagrams showing good / poor standing posture – which diagram best represents good standing posture, and poor standing posture. Make up a list of points that distinguish the two.
- The diagram which best matches good postural alignment also shows the vertebral column in its natural shape. One of the best ways to avoid back pain whilst carrying out daily tasks is to try to learn to maintain the backbone in its natural shape.
- Below is a list of stick men in various states of postural alignment. Your task is to place them under the appropriate headings – good posture, poor posture.

Figure 1 Good standing posture

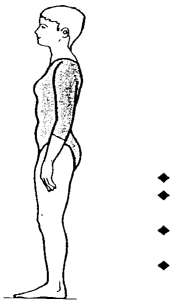
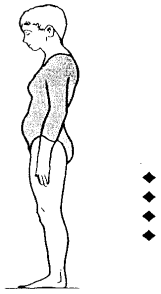
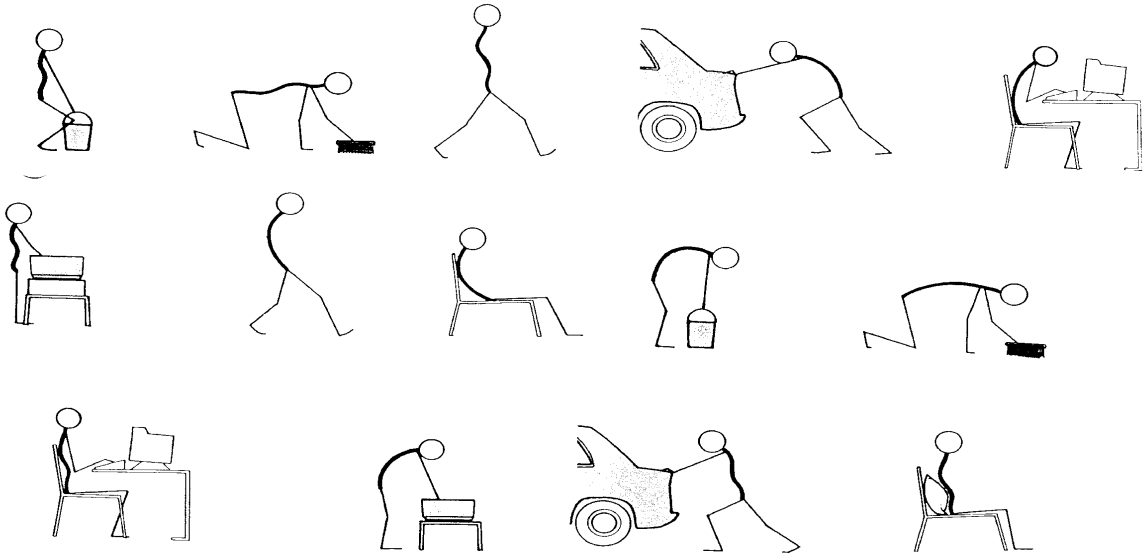


Figure 2 Poor standing posture





poor posture

good posture

See **Balance and Posture** section in the Science Folder for information about stability and equilibrium. The following websites provide information regarding spinal health and ergonomic furniture design for students

http://www.kidshealth.org/PageManager.jsp?dn=poehealth&lic=111&cat_id=20116&article_set=22665&ps=204
http://www.working-well.org/kidstation.html

Suggested teaching and learning approach: In physics we learn that a body/ object is balanced when its centre of gravity is directly in line with its base of support. This centre of gravity is a point about which the mass of a body is equally distributed and if one were to support the body at this point, it would be in equilibrium. All bodies regardless of their shape, size or density have such a point. Objects, such as a basketball, a house brick, a computer and a person standing erect have their centres of gravity located ***inside*** their bodies. Other objects by their very nature and construction may actually have the centre of gravity located ***outside*** their body e.g. a T-square, a compass used in geometry. Similarly, the position of the human body whilst doing particular movements may shift the centre of gravity to the outside of the body e.g. a person doing the Fosbury flop in high jump.

If the human body is well aligned then we could consider that a plumb line extended from the head to the feet would pass through which points? Check this against the 'Good Posture' diagrams supplied in the Science Resources for Teachers Folder.

Postural changes as a result of external forces, bad habits or just too much weight!

Balance

Good ideas to test and improve your balance

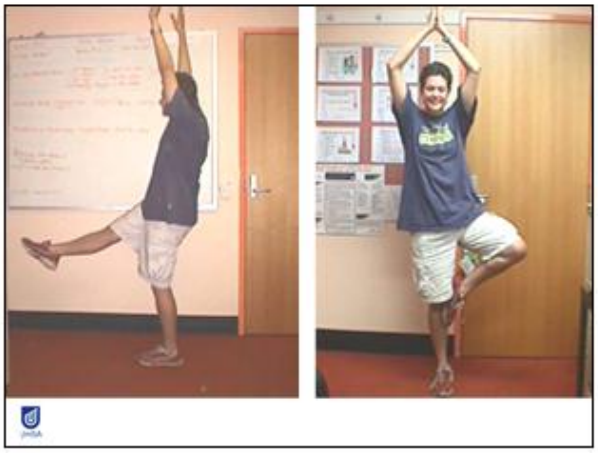
UniSA

Standing on one leg is a good test of motor planning, balance, body image in space, and motor control

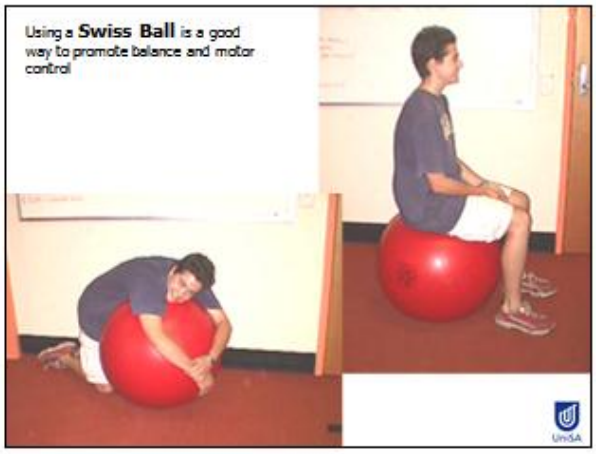
Try doing these tests on the dominant leg, and then on the non-dominant leg

Is there any difference in performance between the tests?

UniSA



Using a **Swiss Ball** is a good way to promote balance and motor control




Handstands are a great way to stretch, find out about your body, and improve your balance and motor control.
UniSA


UniSA

Using your body for work and play

- Discuss each of these postures
- Look at your classmates' postures
- Discuss what is 'normal' and 'abnormal' posture
- Think about how posture could relate to spinal pain

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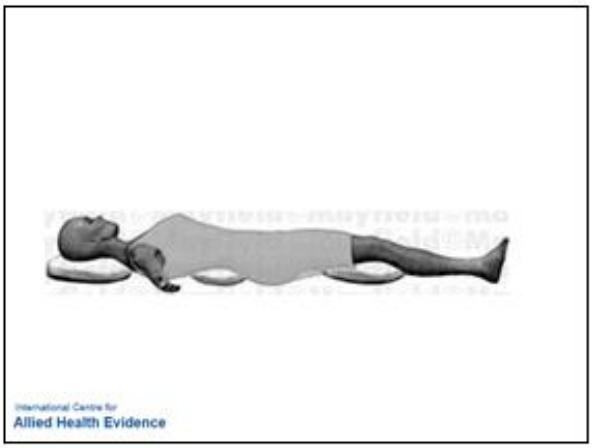
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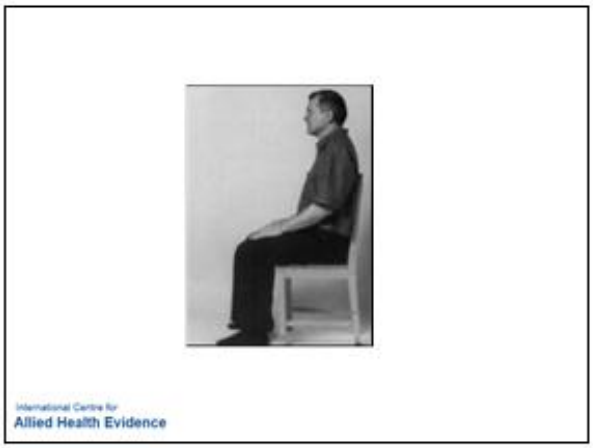
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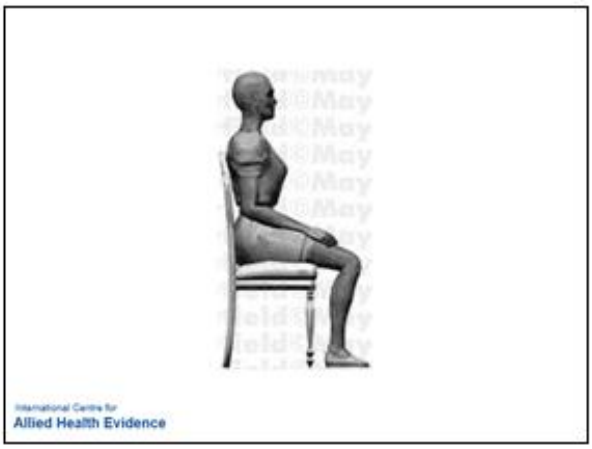
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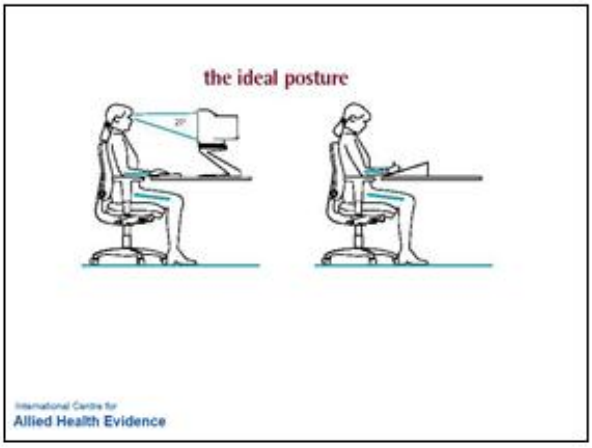
the ideal posture
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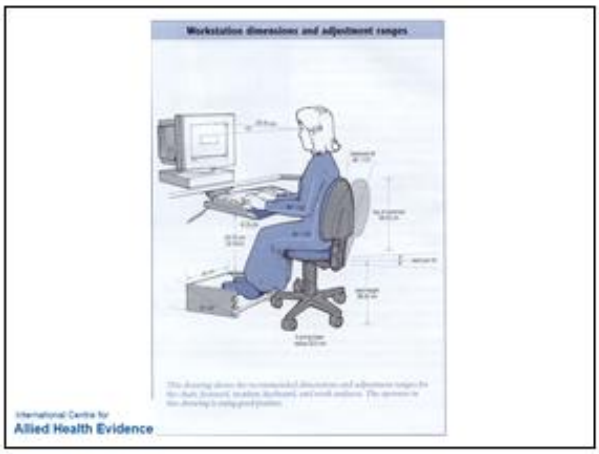
Allied Health Evidence


Workstation dimensions and adjustment ranges
International Centre for
Allied Health Evidence

7.1 HEALTH AND PHYSICAL EDUCATION UNIT 1

This unit of work addresses the following scope key idea in the 'Physical activity and participation' strand of the Health and Physical Education learning area, as given in the SACSA framework.

Students develop, through participation, an understanding of the components of fitness that influence their healthy growth and emerging physical capabilities. They are able to plan and make changes to those practices and values that are harmful or counterproductive F. Id. KC3. In particular, this unit of work focuses on;

- Critically analysing and reporting on the concept of health- related fitness. Students explore effective methods of developing their strength, cardio-respiratory endurance, body mass, and muscular endurance and flexibility to achieve personal fitness goals **Id.** KC1
- Monitoring their own physical activity levels using a range of methods and devices, including electronic forms, to realistically appraise their own fitness levels and plan, develop and act on practical solutions to suit their own situations **T.** KC3. KC5. KC6. KC7
- Discovering and managing the impact on the developing self of the benefits that a range of physical activities can provide (e.g. having fun, contributing to health and wellbeing, and interacting with others and working in teams) **Id.** KC4

This unit of work can be evaluated using the appropriate Standard 4 outcomes provided in the SACSA framework.

STANDARD 4
4.1 Students reflect on the use of specialised skills in various social contexts (including teams) and are able to modify skills to improve performance.
*KC1 * KC4*
4.2 The student evaluates their own beliefs about fitness and undertakes activities of interest to develop a preferred future of health related fitness.
*KC1 * KC3 * KC4*

7.1.1 Specific Objectives

1. To teach students about the concept of spinal health
2. To teach students about the concepts of physical fitness and its components
3. To teach students about the connection between posture and spinal health
4. To teach students, and to reinforce the importance of, good spinal postures in a variety of positions, and whilst undertaking a variety of tasks
5. To encourage students to explore the relationship between spinal health and physical fitness
6. For students to evaluate their own levels of physical fitness in a reliable, valid manner
7. To encourage students to appraise their level of physical fitness and to develop a plan to improve their fitness
8. For students to re-evaluate their level of physical fitness at least 3 months after undertaking this unit of work

7.1.2 Key ideas overview

Strand: Physical Activity and Participation

In this strand students develop, through participation, an understanding of the components of fitness that influence their healthy growth and emerging capabilities. They are able to plan and make changes to those practices and values that are harmful or counterproductive.

For the purpose of this unit the focus will be on physical activity, recognition of the components of fitness, and tests that quantify various levels of fitness. Regular physical activity is essential for good posture and schools should ensure that the curriculum supports regular whole body physical activity.

7.1.3 Information required to complete the unit

- Students need to research the components of fitness.
- Each component of fitness needs to be identified and understood.
- Students need to research the specific tests that are available to measure each component.
- Once the tests have been identified protocols for each one need to be established.
- Students could then draw up a class data record form using a spreadsheet.
    - Perform each of the tests identified according to the established protocols and record their results. (Each test should be completed twice)
    - Compare their results with the percentile tables by age and sex[2]
    - Establish a class database using the results and then compare these at regular intervals throughout the term, semester, and year.

We have also included, an alternative set of tests in the resource folder, the 20 Brace tests (Brace 1927), which despite their age, are still excellent tests for balance, coordination and motor planning.

[2]Percentiles are from the ACHPER designed Australian Schools Fitness Test for students aged 7 – 15.

7.1.4 Suggested units of work/ tasks

Objective 1: ***To teach students about the concepts of spinal health***

Students should consider the following questions.

- What is spinal health?
- What are the components of health?

Tasks

- **Consider what is health? [C]** Students should develop an understanding that health is no longer thought of as being a disease- free state, but as a state in which wellbeing is achieved. Health is defined by the World Health Organisation as 'physical, mental, and social wellbeing, not merely the absence of disease and infirmity' (see Science Resources for Teachers)
- **Consider the components of health [C]** As well as physical, mental and social wellbeing (as discussed above), a holistic view of health may also incorporate emotional, spiritual and intellectual wellbeing.
- **Brainstorm and list** what being healthy means to individual students **[I]**
- **Discuss [SG]** the definition of health as given by the World Health Organisation (See below) - how does this differ from their perception of health?
- **Discuss [SG]** the inclusion of emotional, spiritual and intellectual wellbeing under the definition of health- do students view these as important?
- **Divide [SG]** their list of what being healthy means to them into the following categories; physical, mental, social, emotional, intellectual, spiritual, and report back to the class. What categories were not well addressed in the lists? What else could be added to the list to ensure that all areas of health were being addressed?

Objective 2: ***To teach students about the concept of physical fitness***

Students need to be able to answer the following questions:

- What is physical fitness?
- Why is it important to be physically fit?
- What are the components of physical fitness?
- How do I become physically fit?

Tasks

1. **Write a list [I]** of all the physical activities which students undertake in an average week- including formal and informal exercise
2. **Divide the list [I]** up into the components of fitness which each activity represents
3. **Consider their list**: **[I]**
    - Do they consider themselves to be physically fit?
    - What components of fitness are/ are not well addressed?
    - How could they increase their levels of physical activity to become more fit? How could they adapt their lifestyle to incorporate more activity?

Objective 3: *To encourage students to explore the relationship between spinal health and physical fitness*

Students need to be able to answer the following questions;

- What is the relationship between spinal health and physical fitness?
- What components of physical fitness are important for good spinal health in an individual?

Tasks

1. **Draw up the components of fitness** [**SG]** Ask the group to brainstorm how each of the components of fitness is important in spinal health.
2. **Brainstorm** how poor spinal health may affect an individual's ability to develop physical fitness **[SG].**

Objective 4: *For students to evaluate their own levels of physical fitness in a reliable, valid manner*

Students need to be able to answer the following questions:

- Why is it useful to evaluate components of fitness?
- What are some common methods used to evaluate the components of fitness?
- How do I compare with standard levels of fitness for my age and gender?

Tasks

1. **Discuss** the benefits of testing components of fitness
2. **Perform tests** for the main components of fitness, and record the data collected (see PE Resources for Teachers)
3. **Compare the data** to age and gender standardised norms where possible (see PE Resources for Teachers)

Objective 5: ***To encourage students to appraise their level of physical fitness and to develop a plan to improve their fitness***

Students should to be able to answer the following questions:

- How physically fit am I?
- How could I improve my physical fitness?

Tasks

1. **Identify areas** of their own individual fitness where they are fit, and areas where they require improvement
2. **Consider** the components of fitness and how each component could be addressed.
3. **Develop** an individualised fitness programme for themselves, setting themselves realistic goals, to incorporate more exercise and physical activity into their lifestyle, in order to become more physically fit.
4. **Appraise** their physical fitness based on results of the testing of physical fitness components (see Objective 4), and based on the amount of physical activity which they do overall (see Objective 2).

Objective 6: ***For students to re- evaluate their level of physical fitness at least 3 months after undertaking this unit of work***

Students need to be able to answer the question:

- Has my physical fitness improved?

Tasks

1. **Repeat the fitness evaluation test** they chose in Section 4, or any other measure of fitness they completed in Section 4, and compare the results.
2. **Consider improvement**. If they had not improved on testing, identify why?

7.2 HEALTH AND PHYSICAL EDUCATION UNIT 2

This unit of work addresses the following scope key ideas in the 'Health of individuals and communities' strand of the Health and Physical Education learning area, as given in the SACSA framework:

- Students consider the range of influences on their health associated with increasing freedom of choice, critically examine information available about those choices, and devise personal and community strategies based on them. **F. In. T.** KC1.KC6
- Students learn to assess and build their understanding of skills to effectively manage risky and challenging situations for themselves and others. **In. T**. KC6
- Students increase their knowledge of and skills for healthy dietary practice. They research and critically analyse information, including online, on food choice, and identify the influence of peers and the media on nutritional choices. **Id. T. C.** KC1

This unit of work can be evaluated using the appropriate Standard 4 outcomes provided in the SACSA framework.

STANDARD 4
4.4 Students analyse the changes associated with growth and development and uses problem solving skills to manage significant transitions and issues in their own and others lives.
*KC1*Kc2*KC6*KC7*
4.8 Students understand a range of influences on nutritional needs and implement a dietary strategy for adolescence.
*KC1*KC3*KC7*

7.2.1 Specific Objectives

1. To teach students about osteoporosis
2. To encourage students to think about how they can prevent the development of osteoporosis

7.2.2 Key ideas overview

Strand: Health of Individuals and Communities

In this strand students increase their knowledge of and skills for health dietary practice. They research and critically analyse information, including online, on food choice and identify the influences of peers and the media on nutritional choices.

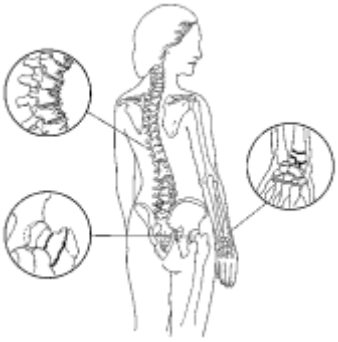
For the purposes of this unit the focus will be on proper exercise and diet and its corresponding role in bone growth.

Summary: it is of vital importance to have proper exercise and diet in childhood and adolescence to prevent osteoporosis in later life. The first two decades of our lives are the key to prevention of osteoporosis which makes us susceptible to breaks and fractures.

7.2.3 Information required to complete the unit

Students need to research **osteoporosis** and find out the following information:

- What is it?
- Who gets it?
- Why do they get it?
- How do you know if you have it?
- What can you do about it?
- What can your doctor do?



7.2.4 Suggested units of work/ tasks

Objective 1: ***To teach students about osteoporosis***

Students need to be able to answer the following questions:

- What is osteoporosis?
- Who gets osteoporosis?
- Why do they get osteoporosis?
- How do you know if you have osteoporosis?
- How does osteoporosis impact upon spinal health?
- What can your doctor do to help the symptoms of osteoporosis?
- Are there developmental childhood diseases that mimic osteoporosis? (eg Osteogenesis Imperfecta)
- How does diet help prevent osteoporosis? What foods can be substituted if you have a dairy allergy?

Objective 2: ***To encourage students to think about how they can prevent the development of osteoporosis***

Students need to be able to answer the question:

- What can you do to prevent osteoporosis from occurring?

Tasks

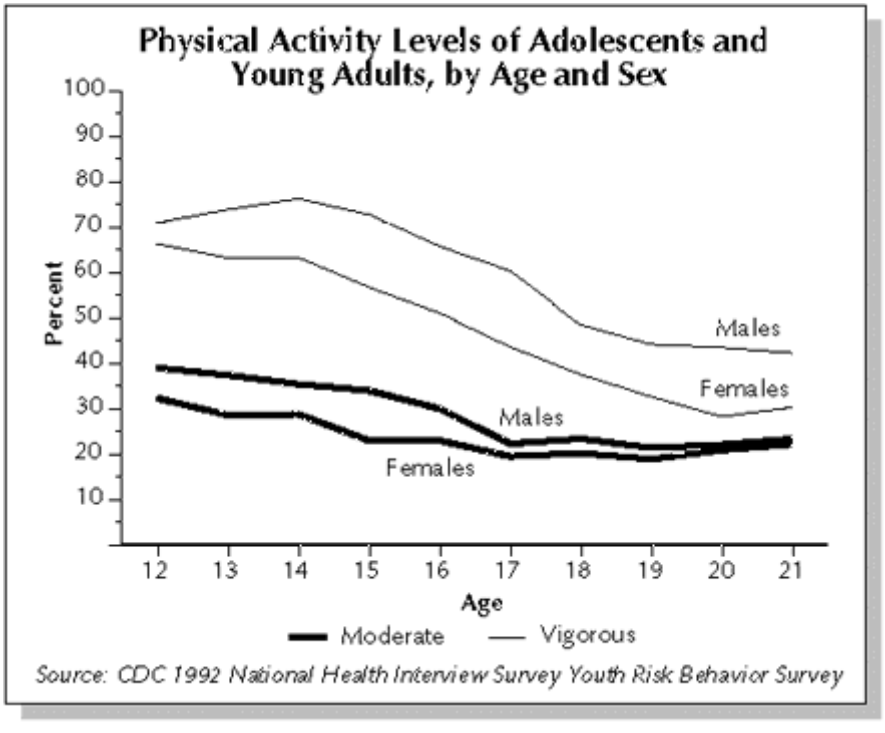
1. **Research** the topic of osteoporosis (using the questions above as guidelines) The websites in the **Health and PE Teachers' Resource Section** provide good information. Alternatively, students could look up 'osteoporosis' on Internet search engines such as Google**. [SG] [I]**
2. **Report findings** back to the class.
3. **Work out** individual plans of action for minimising the likelihood of getting osteoporosis. **[SG] [C]**
4. **Develop a presentation for other Year 8 classes**
5. **Develop** a presentation for their parents
6. **Construct** a menu for a day, considering the foods that help to reduce osteoporosis.

Health and PE Resources for Teachers

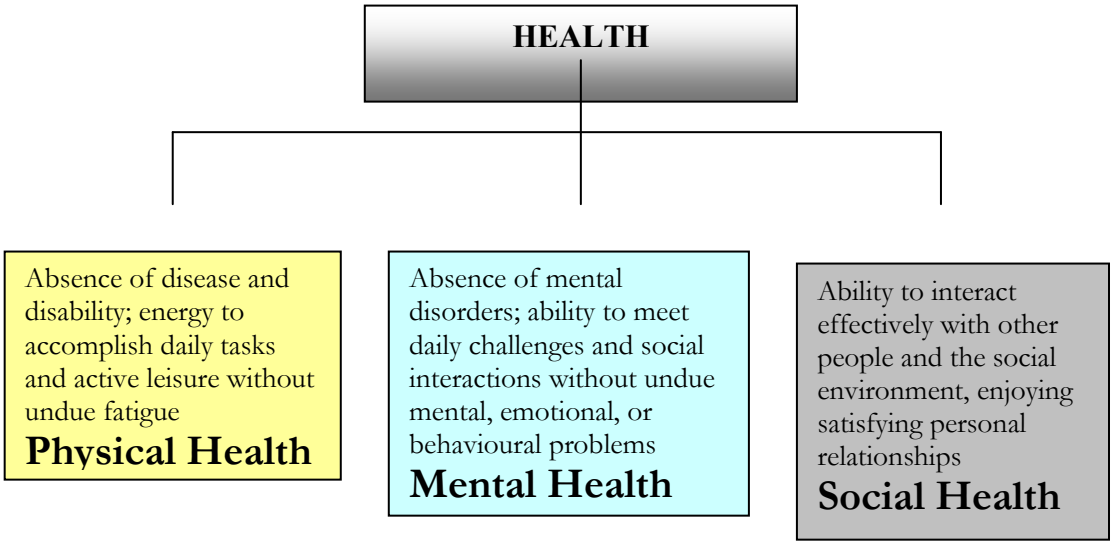
Resources and references

www.nevdgp.org.au/ginf2/murtagh/elderly/Osteoporosis.htm.
www.physiotherapy.ca/release2003_7.htm
www.defyinggravity.net/bone.htm
www.chdf.org.au
http://www.smartplay.net/ouch/anatomy/bones_joints.html
http://www.smartplay.net/ouch/medical/bone_bits/bonebitsinfo.html
http://www.fitness.gov/activity/activity6/influences/influences.html
http://www.cdc.gov/nccdphp/sgr/adoles.htm
http://www.canfit.org/
http://www.in.gov/isdh/dataandstats/yrbs/physical_activity.pdf

American College of Sports Medicine (2000): ACSM's Guidelines for Exercise Testing and Prescription. Franklin B (Ed.). Lippincott Williams and Wilkins, USA.
American College of Sports Medicine (2001): ACSM's Resource Manual for Exercise Testing and Prescription, 4th Edition. Roitman J (Ed.). Lippincott Williams and Wilkins, USA.
Heyward VH (1991): Advanced fitness assessment and exercise prescription, 2nd Edition. Human Kinetics Books, Canada.
Nieman DC (1999): Exercise testing and prescription; a health- related approach, 4th Edition. Mayfield Publishing Company, U.S.A.
Wright P (1997): Inside and Out: a health and physical education textbook, 2nd Edition. Jacaranda Wiley Limited, Australia.



Expansion of the definition of Health (WHO) (Nieman 1999)



What is physical fitness?

Background information Research has shown that physical activity levels tend to decrease when children reach adolescence, and this trend has become more obvious in recent years, perhaps due to the availability of technologies such as the Internet. Added to this, obesity levels continue to rise. Adolescents need to be motivated to improve their physical fitness and the school setting is ideal to provide the education and structure necessary to help achieve this goal.

What is physical fitness? Physical fitness is a set of attributes that people have or achieve, which relates to the ability to perform physical activity. Physical fitness is the opposite of being fatigued from ordinary efforts, to lacking the energy to enter zestfully into life's activities, and to becoming exhausted from unexpected, demanding physical exertion. Physical fitness is an important component of health, and revolves around exercise, having a healthy diet, having an active lifestyle, and avoiding activities that are detrimental to physical health (such as smoking, drinking excessive amounts of alcohol etc.). A person can become physically fit by partaking in physical activities.

Why is it important to be physically fit? The current lack of physical fitness in young Australians is a real concern for the community. Many people do not realise that normal growth and development can only occur if there is a certain amount of physical activity undertaken. Being physically unfit impacts upon young peoples' lives on all levels, and often, unhealthy habits can predispose a person to health issues later in life. A significant amount of government health expenditure is spent every year researching and treating people for diseases which are known to be related to obesity/ poor physical fitness. These diseases are not only expensive, but reduce the community's productivity, and on a personal level, can impact significantly on all areas of wellbeing.

Individual benefits of regular physical activity and/ or exercise include:

- Improvement in cardiovascular and respiratory function, and other components of fitness (see below)
- Reduction in Coronary Artery Disease risk factors

- Reduction in overall rates of sickness and death, including a reduction in risk of developing various chronic physical conditions (cardiovascular disease, high blood pressure (hypertension), obesity, cancer of the colon, type 2 diabetes, osteoporosis)
- Postulated decreased anxiety and depression
- Postulated enhanced feelings of wellbeing (including self esteem)
- Postulated enhanced performance of work, recreational and sport activities

(American College of Sports Medicine 2000)

What are the components of physical fitness? There are many components of physical fitness, all of which are important, and many which we often do not think about. The main components, and their definitions, are;

- *Cardio respiratory endurance* (also called aerobic endurance) is the ability of the heart, lungs, and circulatory system to supply oxygen and nutrients to enable muscles to work efficiently. Good cardio respiratory endurance is needed to exercise for sustained periods of time, and is particularly needed for activities such as playing a game of football, or middle to long distance running.
- *Muscle strength* is the maximum force or tension level that can be produced by a muscle group. The stronger the person, the greater force that can be produced. Weight lifters work constantly to improve their muscle strength by lifting more and more weight to build their muscles.
- *Muscle endurance* is the ability of a muscle group to maintain sub maximum force levels for extended periods. Common exercises done to increase muscle endurance are sit- ups and push- ups.
- *Body composition and body weight* Body composition refers to the body's relative amounts of fat, and lean body tissue, or fat free mass (e.g. bone, muscle). Body weight refers to the size or mass of the individual, which is the fat weight (weight of fat tissue), and the fat- free weight (weight of the remaining lean tissue). These measures are of interest because they relate to sports performance and health.
- *Flexibility* is the ability to move a joint fluidly through its' complete range of motion. Flexibility is limited by such factors as bony structure of the joint and the size and strength of muscles, ligaments and other connective tissues. A certain amount of flexibility is required for all physical activity, and is protective against musculoskeletal injury. Flexibility can be improved greatly by including stretching exercises in the daily routine, and activities such as yoga improve flexibility.
- *Balance* is the ability to maintain equilibrium while stationary or in motion. Certain physical activities depend on a high level of balance, such as surfing, skateboarding, and gymnastics.
- *Coordination* is the ability to use senses, such as sight and hearing, together with body parts, in performing motor tasks smoothly and accurately. All ball sports require high levels of coordination, as do activities such as rock climbing, and trampolining.

How do I become physically fit? There are no hard and fast guidelines currently available for physical fitness in adolescents. Experts agree that adolescents should be physically active almost every day as part of games, sport, work, transportation, recreation, physical education or planned exercise. Physical activity can include things like; walking, gardening, chopping wood, vacuuming, climbing stairs etc. Spending less time in sedentary activities (watching television, reading), and more

time active increases physical activity levels. Experts also recommend that adolescents are involved in three or more sessions a week of activities that last 20 minutes or more and require moderate to vigorous levels of exertion. Activities could include; running, swimming, dancing, or cycling.

Becoming physically fit involves a lifestyle evaluation and plan, not just increasing the number of times per week which sport is played.

Measurement of Physical Fitness

Why is it useful to evaluate components of fitness? Fitness testing is useful for the following reasons (ACSM):

- Educates participants about their present fitness status relative to health-related standards and age and gender matched norms
- Provides data that is helpful in the development of exercise prescriptions to address all fitness components
- Collects baseline and follow- up data that allow evaluation of progress
- Motivates participants

What are some common methods used to evaluate the components of fitness? There are many methods available to evaluate components of fitness, and it is difficult to say that any one method is better then others.

Refer to the table below for commonly used methods of evaluating components of fitness. (Wright 1997)

Component of fitness	**Test**
Cardiorespiratory endurance	The multi- stage fitness test The 1.6km run
Muscle strength	Standing long jump Grip strength dynamometer The basketball throw
Muscle endurance	Push- ups on chair Curl- ups
Flexibility	Sit and reach
Coordination	Hand wall toss
Balance	The stork stand

Another good reference for fitness and skill evaluation is:

Graham G. Motor skill acquisition: an essential goal of physical education programs. *Journal of Physical Education Recreation and Dance* 1987; 58:44-8.

And don't forget the Brace tests which were provided in the Science Resources for Teachers Section

There are a number of other resource kits available for fitness testing of school students, for example the Fitness Gram, and the AFEA. These kits provide further information about specific tests that could be used for testing fitness components, and provide the resources for data collection and comparison of results with averages. When choosing which methods to use, consider the following:

- Does the school already have standard methods of evaluating components of fitness? If so, consider using these first. The school will already have the

necessary resources and students may have already undertaken this testing previously, giving good comparison data.

- The main components of fitness should be evaluated, specifically cardio respiratory endurance, muscle strength and muscle endurance.
- Ensure that there is an easy way to collect and store the data
- Ensure that you have access to population based data so that data collected from students can be compared to averages.

How do I compare with standard levels of fitness for my age and gender? Students should compare their data with standards supplied by their teacher. This will ensure that they have an idea of how fit they are in comparison to the average for their gender and age, and give them a basis for comparison next time the tests are conducted.

Resource manual for curriculum for first year high school students:
Developing good lifelong spinal health behaviors

To be used at teachers' discretion and in conjunction with the Additional Material

Exercises

Good ideas to test and improve your fitness and flexibility

UniSA

UniSA

UniSA

UniSA

UniSA

UniSA

8. SOCIETY AND THE ENVIRONMENT

This unit of work addresses all four scope key ideas in the 'Social systems' strand of the Society and Environment learning area, as given in the SACSA framework, which are:

- Students recognise connection between roles, structures, functions and limits of various political, legal and economic systems over time. **F. In. T.** KC1
- Students work cooperatively to collect, analyse, and describe information about particular issues which have social, economic and environmental dimensions. They identify key ideas, justify positions, predict outcomes and suggest enterprising solutions. **In. T. C.** KC1. KC4. KC6
- Students negotiate and agree on roles, responsibilities, and alternative courses of action in order to achieve goals relating to human rights, democracy, equity, social justice and sustainable environments, at school and in the wider community. **In. T. C.** KC2. KC3. KC6
- Students describe and communicate principles of good resource management and duty of care, and integrate them into socially and environmentally sustainable designing and making practice. **F. In. C.** KC2. KC3

This unit of work can be evaluated using the Standard 4 outcomes provided in the SACSA framework.

STANDARD 4
4.1 Students reflect on the use of specialised skills in various social contexts(including teams) and are able to modify skills to improve performance.
KC1 * KC4
4.2 The student evaluates their own beliefs about fitness and undertakes activities of interest to develop a preferred future of health related fitness.
KC1 * KC3 * KC4
4.11 The student explains some implications (e.g. health requirements, safe work practices) for employers and employees in the production of goods and delivery of services.
*KC1 * KC2 * KC4*

8.1 Specific Objectives

- To encourage students to consider the issue of back injury from economic and social perspectives
- To encourage students to consider the issue of back injury in the workplace from a legal perspective
- To encourage students to consider the importance of hazard management in preventing back injury
- To gain experience in finding practical solutions to 'real life' social issues

8.2 Key ideas overview

Strand: Social systems
In this strand, students work cooperatively to collect, analyze and describe information about particular issues which have social, economic and environmental dimensions. Students will identify key ideas, justify positions, predict outcomes and suggest enterprising solutions. For the purpose of this unit students will examine a significant social issue and, in groups or teams, investigate and explain the nature, background and implications of it, using the case scenario *Robert the Builder.*

Students should consider issues from a social and economic perspective and how these impact on our everyday lives.

8.3 Suggested units of work/tasks

Objective 1: *To teach students about how common spinal pain and injury is*

Students should be able to answer the following questions;

- How common is spinal pain and injury in our society?
- How does this relate to me?

Tasks

1. **Consider** the facts and figures provided regarding how common spinal pain and injury are. **[SG]** (See **Injury statistics** in **Society and Environment Resources for Teachers**). Issues to be discussed include:
    - How does this injury rate compare with other causes of injury i.e road accidents.
    - Why are 15 – 24 year old workers more at risk of injury e.g. new at the job, untrained, undisciplined, still developing in strength etc.
2. **Discuss** how many people students know who are affected by spinal pain or injury, and how this impacts on their lives. Even if they don't know someone who has been injured they should workshop how an injury may affect an individual and his/her family **[SG] [C]**
3. **Consider** the facts and figures in relation to their own risk of developing spinal pain or suffering from a spinal injury **[SG]**

Objective 2: ***To teach students about the national economic impact of spinal injury***

Students need to be able to answer the following questions:

- How much money is spent in Australia on back-related pains?
- What are the other costs to the community of spinal pain?

Tasks

1. Brainstorm all the possible costs of spinal pain to the community **[SG] [C]** or
2. Get the students to research the potential costs to the community nationally and present them to the class. Get them to consider how this money could be better spent in the community **[SG] [I]**

Objective 3: ***To encourage students to consider the issue of back injury from an individual economic and social perspective***

Objective 4: ***Consider the issue of back injury in the workplace from a legal perspective***

Students need to be able to answer the following questions:

- How could back injury impact on individuals and families from:
  - An economic perspective?
  - A social perspective?
- What legislation exists regarding occupational health and safety?
  - What are the responsibilities of employers?
  - What are the rights of the employees?
- Why is it important to have occupational health and safety legislation in place?

Tasks

1. **Read [I]** the case scenario about Robert the Builder **(Society and Environment Resource Material for Teachers)**
2. **Draw up a table [SG]** to include all the members of the family. Under the headings of Robert, Joan, Michael and Elizabeth provide some information on each family member i.e. what each one does, what responsibilities they have etc.
3. **Draw up a table [SG]** as shown below. Under appropriate headings place the financial and social costs that can be identified from the case scenario.

Financial costs $ (economic)	**Social costs (human costs)**

4. **Discuss their findings [C]** in order to appreciate the significant impact which back injury can have on many aspects of an individual's life.
5. **Consider [C]**
   - Why is it important to know about health and safety laws?
   - Why is health and safety in the workplace and at home important?
   - Who are the 'new workers?'
   - 95% or work injuries could be prevented! Explain how this might be done.

Objective 5: ***To encourage students to consider the importance of risk management in preventing back injury***

Students need to become familiar with the concept of 'risk management', and understand these concepts in relation to back care.

1. What other situations may contribute to back pain?
2. Does back pack weight contribute to the risk of back pain?
3. Do the students know how to lift correctly and the possible risks associated with poor lifting techniques?
4. Why is it important to sit correctly at the computer?
5. What are the associated risks with poor sitting posture?

Tasks

1. **Answer** the following questions **[SG]**
   - What are risks associated with back injury?
   - Identify the risks mentioned in Robert's case scenario
   - List four other factors that may have contributed to Robert's accident
   - How could Robert's accident have been avoided?
   - What risks for back pain can you identify in your life, and how could you manage them, to avoid back injury?
2. **Check your computer posture** using the WorkStation.ppt checklist in **Society and Environment Resource for Teachers**. **[I]**
3. **Apply this checklist** at home **[I]**
4. **Report back** to the class on what you found, and how you corrected it (if necessary) **[I]**
5. **Consider** how often during a working day students should adjust their posture **[SG]**

Objective 6: ***To gain experience in finding practical solutions to 'real' life' social issues***

Students should be able to analyse the issue of back injury as discussed in the case scenario and brainstorm possible solutions.

Tasks

1. Consider [C] what Robert the Builder and his family could do to overcome their immediate problems. For example,

- What does Robert need to do to get back to work?
- How can Joan be of assistance?
- What can the children do to help?

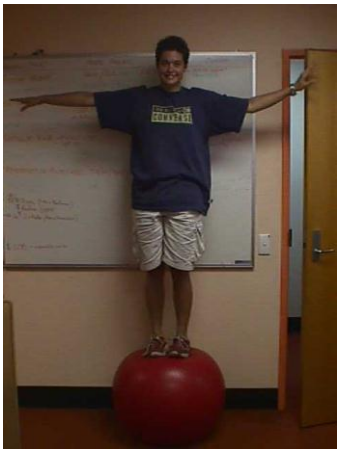
Objective 7: ***Communicating the key issues of school and home safety to class mates.***

Tasks

1. Compose [I] letters or articles to the student council, school newspaper or to the local newspaper outlining what they perceive to be the important issues with spinal care and everyday activities at home and school.

A draft letter is included for reference in **Society and Environment Resource for Teachers**.

2. Consider [SG] ways in which students could present information to their peers which will make a difference to the way in which they behave, and think.



Society and Environment Resources for Teachers

Useful websites for occupational health and safety and hazard identification are:
http://youngworker.healthandsafetycentre.org/pdfs/YoungWorker/studentworksafe/gr7/Gr7TransferableSkillsLessonPlan.pdf
http://www.workcover.com/learning/default.asp
http://www.cca.org.au/content.asp?p=93
http://www.businessranks.com/workplace-safety.htm
http://www.cdc.gov/niosh/homepage.html
http://www.orosha.org/cergos/index.html
www.spine-health.com/topics/cd/ergo/ergo03.html
www.healthinsite.gov.au/topics/Back_Injuries
www.workcover.com/safety/managingsafety/msSafetyBackInjury.asp
www.ccohs.ca/oshanswers/ergonomics/inj_prev.html

Robert the Builder

Robert is a 43 year old male, who works for himself as a house builder. He is married to Joan, and they have two children Michael (Age 13) and Elizabeth (Age 10). Joan works from home doing the accounts and paperwork for Robert's building business. They own one car and the work truck but only Robert drives.

Robert is 1750mm tall and weighs 90kg. He tries to keep fit by walking to the beach once a week, but his work commitments have kept him very busy lately and he hasn't had any free time to do this exercise.

Robert's Building business has been slow in the past 12 months so Robert has put off a couple of his workers, so he has been doing a lot more of the work himself.

On weekends Robert enjoys playing football with Michael at the local park and spends a lot of Saturday driving Michael and Elizabeth to their sporting commitments. Michael plays football and Elizabeth plays netball.

One Friday in July Robert was hurrying to finish a job as it was starting to rain and he wanted to get home before it started. He lifted a wooden beam from the ground to put it in the back of his truck. The beam weighed over 40kg and he had to lift the beam and turn to the side to put it in the truck.

Robert felt a sharp pain in his back when he lifted the beam, he dropped the beam and had trouble straightening up. He walked around the building site for a while until his back eased a bit. He then threw a plastic sheeting over the beam to keep the rain out, finished work and went to the hotel for a quick drink with his mates. Robert's pain settled a bit by the time he got home.

When Robert got home he sat in his favourite old arm chair to watch the news on TV. After the news he tried to get up, but felt severe back pain and once more he could not straighten up.

Joan called the Doctor who came straight out. The doctor gave Robert some pain killers and prescribed several days bed rest. He also suggested that Robert should think about changing his job to another type of work that wasn't so physical. Robert lay in bed for two days with a hot water bottle on his back. Joan had to sleep in another room because Robert would wake up with pain every time she turned over in bed

On Saturday Michael had an important football game a long way away, but Robert could not get out of bed to drive him there. Michael was pretty angry because he had to phone the coach and tell him he couldn't play that week, even though there was going to be State team selectors at the game.

By Sunday night Robert was still in a lot of pain. Joan had to ring his old workmates and ask if anyone could work for him that week, but they were all busy in their own jobs. She then had to phone Robert's customers and tell them that Robert would not be able to work on their building that week. They were upset because they needed the roof put up before the rain got too bad. Joan then had to phone their insurance company on Monday morning to lodge a claim on their Accident and Sickness policy and was told that there would be a six week wait before replacement salary money could be forwarded to them.

None of Robert's mates came to see him that week and Joan got very cross with him because when he was in pain he was very depressed and angry all the time. He was worried that his mates would think that he was making out that his back was worse than it really was for compensation reasons.

Resource manual for curriculum for first year high school students:
Developing good lifelong spinal health behaviors

To be used at teachers' discretion and in conjunction with the Additional Material

Draft of a letter to SRC from year 8 student

Dear SRC,
As you have probably noticed the majority of students at our high school carry bags that are either far too heavy or are worn incorrectly; and in many cases both.

I believe that students should wear their school bags the right way. If a student does not wear their school bag correctly they can experience sore muscles and light back sprain. As if that isn't bad enough they can also cause themselves severe problems later in life. To help this problem I think that punishments or detentions should be given out by teachers who happen to see a student carrying their bag on one shoulder or with it ridiculously low down on their back. Another thing that would help is for students to have a bag cleanout once or twice a term to get rid of unnecessary junk.

I think that students should also be reminded to sit and stand with good posture and not to slouch.

Most students (particularly girls) seem to think that it is more fashionable to carry their school bag over one shoulder. I think that this should be discouraged. Not only is it bad for your back but also it looks untidy and doesn't help our school live up to its excellent reputation.

I hope that I have convinced you that something must be done about this increasing problem.

Yours sincerely,
Kate Williams.

Costs of Workplace Injuries

- up to 500 workers die in Australia each year
- up to 600 000 claim workers compensation
- annually, this costs Australia $10 - $15 billion
- up to 33 new workers are injured every day in SA
- 15 - 24 yr olds have a 75% greater risk of being injured at work
- 95% of work injuries could be prevented

- The financial impact of these injuries on the state is conservatively estimated at $100million each year.

Computer Workstation Set-up Checklist

Use this checklist in assisting you to optimize your workspace. Remember to work in the best postures possible. If necessary, please contact your Office Ergo Rep for assistance.

Name:	**Date:**
Job Title:	**Office Ergo Rep:**
Department:	**Supervisor:**
Tasks:	**Signs and Symptoms (if any):**

1. Chair Note: sit with buttocks fully up against the back of the chair		**OK**	**NO**	**ACTION**
Seat height	Adjust the seat height so feet are flat on the floor or footrest, knees are bent at right angles and thighs are horizontal to floor.			
Back rest height	Adjust the back rest height so that the lumbar support of the chair fits the curve of your low back (lumbar curve).			
Seat pan depth	There should be about 2-4 finger widths between the front edge of the seat and the backs of knees. (Adjust if it is possible).			
Tilt	Adjust seat tilt so hips and tops of thighs are at right angles or slightly greater. Vary throughout day.			
Armrest position	Adjust armrests so that they are out of the way while typing, but may provide support during other activities (i.e. phone use, meetings, etc.).			

2. Keyboard and Mouse Note: Mouse and keyboard should be at the same height		**OK**	**NO**	**ACTION**
Keyboard/ mouse height	Adjust keyboard/ mouse height so elbows are at right angles (like a square) or slightly greater (90 to 110 degrees) and forearms and hands form straight lines to the keyboard. **Note: if your keyboard/ mouse height is not adjustable**, adjust your seat height so that your elbows are at right angles or slightly greater (90 to 110 degrees) and forearms and hands form straight lines to the keyboard.			
Mouse height	Adjust mouse so it is close to and on the same level as the keyboard.			
Keyboard-to-user distance	Keyboard-to-user distance should allow user to relax shoulders with elbows hanging close to body.			
Keyboard slope	Position keyboard flat or slightly negatively sloped, ie. sloped away from the user.			
Mouse-to-user distance	Mouse should be directly next to the keyboard. If possible, use mouse with the left hand on the left side of the keyboard to reduce the reach to the mouse.			
Hand posture with the mouse	Mouse with the base of the hand resting on the mouse. If fingers are too long for the mouse, get a larger mouse or use a **mouse mate**.			
Speed of the mouse	Utilize the settings of the mouse under the **Control Panel** under **Settings** to match your individual needs.			

3. Monitor		OK	NO	ACTION
Monitor height	Adjust monitor height so top of screen is at or slightly higher/lower than eye level. **Exception: Bi-focal/ graduated lens users** adjust the height of the monitor so that the head is straight when viewing the monitor. This may mean raising or lowering depending on which part of the lens you need to look from to see the screen.			
Screen-to-user distance	Viewing distance is approximately arm's distance away (18"- 28"). Larger monitors may be even further away (up to 33"). Judge appropriate distance by checking to ensure the head is straight and not forward.			
Monitor alignment w/ user	Monitor and keyboard should be placed directly in front of user.			
Visual comfort of screen	Monitor should be positioned to avoid glare (perpendicular to window/ strong light source), use blinds as necessary.			
Brightness and contrast controls	Adjust the brightness and the contrast control on the monitor to make it easier to see the screen.			
4. Work Environment and Work Surface		**OK**	**NO**	**ACTION**
Leg clearance at workstation	Width = 2" + hip width, Height= Highest point of thighs or higher, Depth= Allows foot/knee clearance.			
Placement of frequently used items	Keep frequently used items (i.e. phone) within easy reach.			
Placement of source documents	Place documents close to the monitor. Options: on slanted surface in space between monitor and the keyboard or to the side of the monitor.			
General task lighting	Ensure lighting is not direct or overly bright and that it is on the hard copy. Light is not required on the monitor as it produces its own light source.			

5. Work Practices		OK	NO	ACTION
Frequency of microbreaks	Get out of chair at least once per hour, microbreak every 30 min of keyboarding.			
Alternate tasks	Break up long periods of continuous computer use by performing small tasks/ errands.			
Keyboarding/ mousing posture	Keep wrists straight, avoid supporting wrists on any surface while typing. It is OK to rest occasionally when not typing on the sides of the hand.			
Sitting posture	Upright or slightly reclined posture, maintain slight curve in lower back.			
Phoning posture	Avoid tilting head/neck to cradle the phone. Use hand to hold receiver or wear headset.			
Reach posture	Stand to get items from overhead shelves. Do not reach over shoulder level.			

Statutory Requirement - Ergonomics (MSI) Regulation 4.50
For submission and action by Administrative Heads of Unit or nominated representative.

Recommended Measures	Action By Whom?	By When?	Done

Adolescent posture, spinal pain and backpacks

The facts about back pain

- $700 million spent on spinal pain in Australia per year
- Up to 80% Australian adults suffer from spinal pain at least once in their lives
- Significant impact
  - Work productivity
  - Psychologically
  - Leisure time

The facts

- Up to 44% of high school students suffer from back pain at any one time
  - Neck pain is most common, followed by
  - Lower back pain followed by
  - Thoracic (upper back)
- Things that increase back pain
  - Heavy bags
  - Long time spent carrying bags
  - Regular use of computers
  - Using poorly designed furniture

Steps to carrying backpacks properly

- Always use a backpack to carry your school loads (rather than a satchel).
- Re-pack the backpack each day and carry only what you need
- The weight of the packed school bag should never exceed 10% of your body weight
- Always pack the heaviest items closest to the spine
- Close all zips and buckles to prevent the bag sagging away from the spine
- Wear the pack over 2 shoulders at all times
- Do not allow the base of the pack to sit below the line of the hips

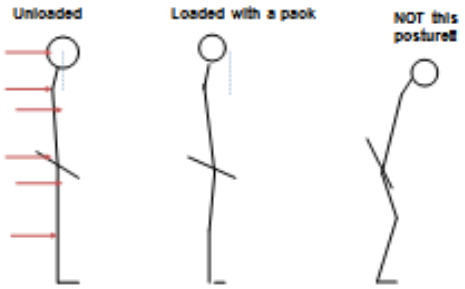
Requisite features of a backpack

- hard wearing
- waterproof
- waist and side compression straps
- wide, padded shoulder straps
- padded back support
- functional zips
- external pockets
- sized by ratio of bag length to student trunk height
- demonstrated quality control
- internal organisers
- limits on loads
- instructions provided at point-of-sale

An unfortunately common sight

So, what is 'good' posture?

How do you tell?



What happens to posture under different loads???

Look at what happens to the head
Look at what happens to the shoulders
Look at what happens to the hips

What is the recommended loads carried by adolescents?

What teachers and parents can do to help

- Talk to students about
  - Good posture
    - Make sure you are a good role model
  - Help them look after their spine whilst they study
    - Look at their study environment with them
  - Help them pack and wear their school bag correctly
    - Know what they are carrying and how they are carrying the bag
    - Make sure the bag is not too small or too big for them

when sitting correctly matters

the ideal posture

when using a computer

Posture
Lengthen spine into its natural balanced position, keeping head held over the shoulders and in line with the buttocks.

Chair
Tilt seat forwards or level according to comfort or medical requirement.[1] Adjust seat height so hip joint is slightly higher than knee joint.

Desk height
Middle row of the keyboard should be level with the elbow, (forearms parallel to the floor).
If the desk is too low raise with desk feet, if too high use a foot stand and raise seat height.
Place mouse in easy reach zone by keyboard.

Screen
Should be at arms length and on eye level in front of the user (visual angle 0–21°).
Position at 90° to any light source avoiding glare or reflections. Use copy holder so input data is within field of view.

Telephone
If used for more than 40% of the working day consider a headset to free hands for more efficient working.

Space
Create sufficient room to work especially if multitasking. Place equipment on stands or arms if necessary.

Movement
Prevent static loading. Rock, change position to reduce fatigue. Place one foot in front of the other, alternate position during the day. Take breaks and vary tasks.

(1) The use of a forward tilting seat is not advisable for certain medical conditions, if there is any pain do not persist, use the seat in a level position or where comfortable. Initially vary posture regularly to allow muscle groups to adjust to the new position.

when writing

Posture
Lengthen spine into its natural balanced position, keeping head held over the shoulders and in line with the buttocks.

Chair
Tilt seat forwards or level according to comfort or medical requirement[1]. Adjust seat height so hip joint is slightly higher than knee joint.

Desk height
Elbow should be just below the desk top. If the desk is too low raise with desk feet, if too high use a foot stand and raise seat height.

Writing slope
Raise work using a slope. This reduces viewing distance, lessens eye strain and limits the body leaning forwards. Hold the head upright to maintain a balanced spinal posture.
If taking notes from a book keep it within the field of view using a book attachment above the slope.

Telephone
If used for more than 40% of the working day consider a headset to free hands for more efficient working.

Space
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Movement
Prevent static loading. Rock, change position to reduce fatigue. Place one foot in front of the other, alternate position during the day. Take breaks and vary tasks.

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